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Remedial Action Contract

Sustained Yield Test
Technical Memorandum

Old Roosevelt Field Contaminated Groundwater Area Superfund Site

Remedial Action

Garden City, Long Island, NY

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CDM

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Section 1
Introduction

CDM Federal Programs (CDM) is conducting a Remedial Action at the Old Roosevelt Field Contaminated Groundwater Area Superfund Site (the site) located in Garden City, New York, for the U.S. Environmental Protection Agency (EPA), Region 2, under Work Assignment (WA) 023-RARA-02PE of the Remedial Action Contract (RAC) 2, Contract No. EP-W-09-002. To support construction of the groundwater extraction and treatment system, CDM conducted a sustained yield test, as detailed in the Remedial Design, Section 02525, Well Installation, for the Old Roosevelt Field Contaminated Groundwater Area Superfund Site. The objectives of the sustained yield test were as follows:

- Test the capacity of extraction wells EW-1S, EW-1I, and EW-1D to meet their design flow requirements.
- Obtain site specific aquifer hydraulic parameter data to verify values used in the groundwater flow model of the site.
- Obtain baseline specific capacity data for each extraction well.

This memorandum summarizes the sustained yield test design, equipment, methods, sampling, data analysis, and results. The observed test results are compared to the original design assumptions and the aquifer parameters used in the numerical groundwater flow model. Work was conducted in accordance with Section 02525 except that the flow rates used in the step-drawdown and sustained yield tests were increased, as discussed in this memorandum, to help meet project objectives. Sampling work discussed in this memorandum was conducted in accordance with the *Final Quality Assurance Project Plan* (QAPP)*, Old Roosevelt Field Contaminated Groundwater Area Site Remedial Action, Garden City, NY* dated May 24, 2010 (CDM 2010a).

Section 2
Sustained Yield Test Design, Equipment, and Sampling

2.1 Sustained Yield Test Design

The sustained yield test consisted of the following elements:

- Background water level monitoring at selected wells from August 4, 2010 through September 7, 2010.
- Groundwater quality sampling to provide data for final treatment system design.
- Step-drawdown tests conducted on extraction wells EW-1S, EW-1I, and EW-1D on August 30, September 1, and September 2, 2010.
- Sustained yield test (pumping test) conducted from September 7 to September 10, 2010 during which the three extraction wells were pumped simultaneously at flow rates above their design capacity.
- Recovery water level monitoring from September 10 through September 13, 2010.

2.2 Water Level Monitoring Locations and Equipment Deployment

Starting on August 4, 2010, In-Situ® transducers were installed in eight conventional monitoring wells (MW-1S, MW-1I, MW-2S, MW-2I, MW-3S, MW-3I, GWX-10019, and GWX-10020) and five Westbay wells (SVP-2, SVP-3, SVP-4, SVP-9, and SVP-11). The Westbay wells were converted to monitoring wells by opening one pumping port in each well. Table 2-1 lists the conventional wells, the port opened on the Westbay wells, the dates of transducer deployment and recovery, and the data collection rate. The week before step testing began, In-Situ® transducers were also deployed in the three extraction wells (EW-1S, EW-1I, and EW-1D). Westbay wells SVP-5 and SVP-10 were each instrumented with five Westbay transducers to provide a vertical profile of water level data close to the extraction wells. The data from the Westbay transducers were stored on a Westbay Mosdax recorder installed in a weather proof metal box at each well. Earth Data, Inc., under subcontract to CDM, and their lower tier subcontractor Schlumberger, provided technical support and equipment to deploy the transducers in wells SVP-5 and SVP-10 and to open the pumping ports on the other Westbay wells used as monitoring wells. Well SVP-5 and SVP-10 transducer deployment information is included in Appendix A. The locations of all wells used for water level monitoring are shown on Figure 2-1. The cross section shown in Figure 2-2 trends north-south through the site and illustrates the groundwater flow model layers, site stratigraphy, and hydrogeologic conceptual model. The location of monitoring well GWX-10019, multiport wells SVP-4, SVP-9 and SVP-10, the extraction wells EW-1S and EW-1D, and Garden City municipal supply well GWP-10 are shown on the cross section with respect to the model layers. The location of the cross section shown on Figure 2-2 is shown on Figure 2-1.

2.3 Pumps, Flow Meters, and Water Treatment

Pumps used in the three extraction wells were Myers Ranger, 4-inch submersible pumps. The pumps were provided and installed by Uni-Tech, Inc. under subcontract to CDM. Uni-Tech also provided a trailer-mounted diesel generator to supply power to the pumps as well as flow meters with a digital readout of total and instantaneous flow. The pump specifications and flow meter calibration information are included in Appendix B. Water generated during the sustained yield test was piped to a temporary onsite treatment system operated by INTEX under subcontract to Uni-Tech. The system had a capacity of 250 gallons per minute (gpm). Water was pumped from the wells into a 20,000 gallon holding tank, treated using granulated activated carbon, and then piped to the storm drain on Clinton Road, west of the extraction wells. The storm drain runs into Nassau County Recharge Basin 124, located south of the Garden City wells and outside the area of influence of the extraction wells. Figure 2-1 shows the location of Clinton Road and the recharge basin.

2.4 Groundwater Quality Sampling

To provide data for treatment system design, four sets of groundwater samples were collected during the sustained yield test: 1) at the completion of well development; 2) at the end of the step test on each well, 3) at the start of the pumping phase of the sustained yield test, and 4) at the end of the sustained yield test. Samples were shipped on the day of sampling via FedEx to the EPA Division of Environmental Science and Assessment (DESA) laboratory in Edison, New Jersey. CDM used the sampling results to determine that an iron removal system was not needed as part of the final treatment system. This recommendation regarding treatment system design and a summary of the sample results were conveyed in a letter to the EPA Remedial Project Manger (CDM 2010b).

The first set of samples was collected from each well after development of wells EW-1S, EW-1I and EW-1D was completed. Samples were collected from a sample port on the development pump discharge line from each well. Samples were analyzed for EPA Target Compound List (TCL) volatile organic compounds (VOCs), total iron (Fe) and manganese (Mn), and field filtered Fe and Mn. Three environmental samples were collected in accordance with the QAPP.

The second sample was collected after the step test was completed at wells EW-1S, EW-1I and EW-1D. Samples were collected from a sample port on the pump discharge line. Samples were analyzed for TCL VOCs, total Fe and Mn, and filtered Fe and Mn. Three environmental samples were collected in accordance with the QAPP.

The third and fourth sets of samples were collected during and at the end of the 72-hour drawdown phase of the sustained yield test. Samples were collected from four points: a sample port installed on each of the three wells before the flow meter and a fourth sample port on the common header that combined the discharge from all three wells. The first sample set (A) was collected between 4.5 and 6.5 hours after the yield test started; the second sample set (B) was collected at the conclusion of the sustained yield test. Samples were analyzed for TCL VOCs, total EPA Target Analyte List (TAL) metals (including mercury and cyanide), filtered TAL metals, total suspended solids (TSS), total dissolved solids (TDS), hardness, alkalinity, nitrate/nitrite, and oil and grease. Eight environmental samples were collected in accordance with the QAPP.

Section 3
Aquifer Testing

3.1 Step Drawdown Testing

The design flow rate of wells EW-1S and EW-1I is 60 gpm, while the design flow rate of well EW-1D is 80 gpm. The original step test design called for flow rates ranging from 0.5 to 1.33 times the design flow rate at wells EW-1S and EW-1I, and 0.5 to 1.75 times the design flow rate at well EW-1D. However, high flow rates with relatively little drawdown were observed at all three extraction wells during well development. Therefore, the step test plan was revised and the wells were pumped at the higher rates listed on Table 3-1 during the step test. Each step was two hours long. Higher flow rates were used to maximize the drawdown produced during the step test and thereby produce the most useful results.

Step tests were conducted at wells EW-1S, EW-1I and EW-1S on August 30, September 1, and September 2, 2010, respectively. At the conclusion of the step test at each well, a water sample was collected and sent to DESA laboratory for analysis as detailed in Section 2.3. Manual observations of flow rates and water levels in the extraction wells were made during the step tests and are included in Appendix C.

The flow rate and drawdown data from the step test were reviewed by CDM and the flow rates for the sustained yield test were set at 70 gpm for wells EW-1S and EW-1I and at 110 gpm for well EW-1D. This was done to maximize the stress applied to the aquifer.

3.2 Sustained Yield Test

Before the sustained yield test began, the water level recording rate was changed from 10 minute to 1 minute intervals on the transducers in most of the observation wells as listed on Table 2-1, to better capture water level changes in the wells. The sustained yield test started at 10:30 am on Tuesday, September 7, 2010, when all three extraction wells were switched on at the same time. Flow rates had been preset before the start of the test at 70 gpm for wells EW-1S and EW-1I and at 110 gpm for well EW-1D. Flow rates and water levels in the extraction wells were monitored manually at 15 minute intervals throughout the test. At least three people were onsite 24 hours per day during the sustained yield test to monitor the flow rate and water levels in the extraction and monitoring wells. Flow rates were adjusted as needed to keep them constant during the test. The manual flow rate and water level observations are included in Appendix D. The pumping phase of the test stopped after 72 hours at 10:30 am on Friday September 10, 2010.

3.2.1 Garden City Production Well Monitoring

During the sustained yield test, water levels and flow rates were monitored manually at two nearby Garden City municipal wells, GWP-10 and GWP-11. Water level indicators were installed in each well. During the first two hours of pumping, water levels were monitored at 1 minute intervals for the first

ten minutes and then at 10 minute intervals. After the first two hours, the water level and flow rates were checked every two hours until the end of the pumping phase. During the first two hours of recovery, water levels were monitored at 1 minute intervals for the first ten minutes and then at 10 minute intervals. After the first two hours of recovery, the water level and flow rates were checked every two hours until the late afternoon on Friday September 10, 2010. The flow meter on well GWP-10 was not working, so the on or off status of the well was recorded when the water level was measured. CDM consulted with Garden City Water Department and they reported the flow rate for well GWP-10 was 1,000 gpm. The flow meter on well GWP-11 was working and the well was on throughout the test, and pumped at a rate of about 1,200 gpm. Observations from well GWP-10 and GWP-11 are included in Appendix D.

3.2.2 Groundwater Sampling

As discussed above, groundwater samples were collected during and at the end of the 72-hour sustained yield test, in accordance with the QAPP. Samples were collected from four points: a sample port installed on each of the three wells, before the flow meter, and from a sample port on the common header which combined the discharge from all three wells. The first sample set (A) was collected between 4.5 and 6.5 hours after the yield test started; the second sample set (B) was collected at the conclusion of the yield test. The water quality parameters measured during sample collection are listed in Table 3-2.

3.2.3 Manual Water Level Monitoring

Manual water level monitoring was conducted periodically, before and during the sustained yield test, to check transducer function. All transducers functioned normally throughout the test. The manual observations are included in Table 3-3.

3.2.4 Precipitation and Barometric Pressure

Precipitation and barometric pressure data, for the period including background monitoring through the completion of the sustained yield test recovery, was obtained from the weather station KNYCARLE1, located near the site in Carle Place, New York. A total of 2.7 inches of rain was recorded during the background monitoring period on August 22, 2010, and 0.06 inches of rain was recorded on September 8, 2010, the second day of the sustained yield testing. Hydrographs indicate that precipitation did not impact water levels at site significantly during the pumping or recovery phases of the sustained yield test. These data are included in Appendix E.

Section 4
Data Analysis and Results

4.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model for the site is illustrated in Figure 2-2 and shows the Upper Glacial aquifer, the Upper, Middle, and Basal Magothy aquifer, and the Raritan Clay. This conceptual model has been implemented in the groundwater flow model by dividing the system into 14 layers. After review of the drawdown data plots and the lithologic and gamma log data, CDM identified a local aquitard that, where present, separates the overlying Upper Glacial Aquifer from the underlying Magothy Formation. Lithologic data showed the aquitard thickness was typically 10 to 20 feet but ranged in thickness from 10 to 33 feet. This aquitard is located in Layer 12 of the groundwater flow model, which represents the Upper Magothy aquifer, and is assigned a horizontal hydraulic conductivity (K) of 60 feet/day and anisotropy ratio (vertical hydraulic conductivity, K_z/horizontal hydraulic conductivity, K) of 0.01 in the model. This K value is representative of the bulk K of the unit, which is about 100 feet thick, and not the K of local, relatively thin units like the aquitard. The aquitard was not included in the groundwater flow model due to its uncertain lateral and vertical extent and lack of information on its hydrogeologic properties.

The aquifer thickness used in the data analysis and to calculate K was defined as the distance from the bottom of the aquitard to the top of the Raritan Clay. The average thickness across the wells used in the sustained yield test was 452 feet. Details on well construction, elevation, and aquifer thickness for all pumping and observation wells are listed in Table 4-1. The groundwater flow model layers screened by each well used as a pumping or observation well during the aquifer test are listed on Table 4-2.

The three EW extraction wells, Garden City municipal wells GWP-10 and GWP-11, and most of the observation wells are completed in the Middle Magothy aquifer. The shallowest port, Port 10, in wells SVP-5 and SVP-10 is completed in the Upper Glacial aquifer. The deepest port, Port 1, in well SVP-10 is completed in the Basal Magothy aquifer.

Based on the existing groundwater flow model of the site, previous experience in the area, stratigraphy, and storativity values calculated from displacement data collected during this test, CDM selected a leaky-confined model for analysis of most of the sustained yield test data. Data from some shallow monitoring wells were analyzed assuming unconfined conditions because this model provided the best fit to the data. An anisotropy ratio of 0.01 was used in all analysis.

4.2 Background Water Level Monitoring

The background water level monitoring data were reviewed and showed that the pumping at Garden City municipal well GWP-10 significantly influences water levels in all the observation wells used during the sustained yield test. This is illustrated in the graph of water level data from the five zones (ports) monitored in well SVP-10 shown in Figure 4-1. The on/off cyclic pumping at well GWP-10

causes a variation of approximately 2 feet in the water levels observed at well SVP-10 in Ports 1, 3, and 5 , which are in the same depth range as well GWP-10. The shallow zone, Port 8, is less influenced but still shows the regular pattern of drawdown caused by well GWP-10 turning on and off. The shallowest zone, Port 10, shows no significant influence from pumping in well GWP-10, probably because this zone is in the Upper Glacial Aquifer (see Figure 2-2). During the sustained yield test, well GWP-11 was observed to run all the time. Therefore, it was assumed in the analysis that well GWP-11 pumped at a constant rate before, during, and after the test and therefore did not cause any significant drawdown. Hydrographs of all the data from each well, including the background monitoring period and the sustained yield test period are included in Appendix F.

4.3 Step Test Analysis

The step test data were analyzed using the Hantush-Jacob method for step test analysis (Hantush and Jacob 1955) as implemented in Aqtesolve (Hydrosolve 2011). Figure 4-2 shows a graph of the drawdown data from well EW-1I during the step test. Transmissivity values ranging from 27,160 feet^2/day to 57,850 feet^2/day were calculated based on the step tests. Using an aquifer thickness of 452 feet, K values ranging from 60 to 128 feet/day were calculated. Storativity values ranged from 5.58×10^{-4} to 2.46×10^{-1}. These results are consistent with a leaky confined aquifer conceptual model. Plots of these analyses are included in Appendix G and the results are listed in Table 4-3. The displacement data observed during each step were used to calculate baseline specific capacity values, which are listed in Table 3-1.

4.4 Sustained Yield Test Analysis

Since production well GWP-11 was running before, during, and after the test at a constant flow rate, the well was left out of the analysis because it had no real effect on water levels in the observation wells. In the case of well GWP-10, it was pumping at 10:30 am on Tuesday September 7, when extraction well pumping started, and the well cycled on and off before, during, and after the test. To accommodate pumping at well GWP-10 into the analysis, CDM moved the start time of the sustained yield test back to 3:00 am on Tuesday September 7, 2010 which was when well GWP-10 started pumping immediately prior to the start of extraction well testing. This is practical but arbitrary because well GWP-10 cycled on and off for a long period well before the extraction well pumping started. The on/off cycling of well GWP-10 was incorporated into Aqtesolv which uses superposition to calculate the effect of multiple pumping wells on drawdown in observation wells. The start and stop times for the pump at well GWP-10 were estimated from water level data graphs from nearby observation wells and water level monitoring at well GWP-10.

The pumping period of the sustained yield test is clearly visible in the graph of data from SVP-10 shown in Figure 4-1. When the sustained yield pumping started, the water level in Ports 3 and 5 dropped by about 2 feet because these zones are close to and in the same elevation range as the screened zones in the nearby extraction wells. The water level in Port 1, the deepest zone, was less affected, while the water levels in the shallow zones, Ports 8 and 10 were not impacted.

The water level displacement observations from the extraction wells and observation wells during the sustained yield test were analyzed using Aqtesolv Professional software (HydroSOLVE 2011). Table 4-1 lists the well information and aquifer test analysis input parameters used in Aqtesolv. Based on site conditions, a leaky confined aquifer model was assumed and the Hantush-Jacob (1955)/Hantush (1964) solution for a pumping test in a leaky aquifer was applied to estimate aquifer parameters. In Aqtesolv, this solution also incorporates wells with partial penetration (Hantush 1961a, 1961b). Assumptions of this method are as follows:

- Aquifer has infinite areal extent
- Aquifer is homogeneous and of uniform thickness

- Pumping well is fully or partially penetrating
- Flow to pumping well is horizontal when pumping well is fully penetrating
- Aquifer is leaky confined
- Flow is unsteady
- Water is released instantaneously from storage with decline of hydraulic head
- Diameter of pumping well is very small so that storage in the well can be neglected
- Confining bed(s) has infinite areal extent, uniform vertical K and uniform thickness
- Confining bed(s) is overlain or underlain by an infinite constant-head plane source
- Flow is vertical in the aquitard(s)

These assumptions are generally met by the site conditions because the study area is small relative to the large portion of Long Island underlain by the Magothy Formation; in the study area the aquifer thickness average is 452 feet, as shown in Table 4-1, with little variation; all pumping and observation wells were partially penetrating; and the aquifer can be considered leaky confined.

4.5 Extraction Well Sustained Yield Test Analysis

Plots of the analyses conducted using Aqtesolv on data collected during the extraction well sustained yield test are included in Appendix H. An example of the plot of the analysis of data from well SVP-10, Port 3 is show in Figure 4-3. Elapsed time starts when well GWP-10 turned on at 3:00 am on Tuesday September 7, 2010. The three extraction wells were turned on at 10:30 am that morning, at an elapsed time of 450 minutes, where a jump in drawdown is observed in Figure 4-3. These analyses included pumping from the three extraction wells and well GWP-10. The flow rate at well GWP-10 was assumed to be 1,000 gpm based on discussions with the water department. The on/off times for well GWP-10 were estimated by CDM from water level data collected in wells EW-1D and GWX-10019. Well EW-1D is relatively close to well GWP-10 and is completed in the same elevation range. Well GWX-10019 is the closest observation well to well GWP-10. The influence of well GWP-10 made the analyses more complex because the water level changes caused by well GWP-10 tend to mask changes caused by pumping at the extraction wells. In general, the water level graphs indicate that the change caused by the extraction well pumping occurred quickly and that, if well GWP-10 were not pumping, a new steady state probably would have been achieved within 8 to 24 hours of the start of pumping.

The results of the analysis of the water level displacement observations during the extraction well sustained yield test are summarized in Table 4-3. Transmissivity values ranged from 18,130 $feet^2$/day to 82,430 $feet^2$/day, with a median value of 48,180 $feet^2$/day. Storativity values ranged from $3x10^{-4}$ to $1.53x10^{-3}$ with a median value of $8.15x10^{-4}$. Using an aquifer thickness of 452 feet, K values were calculated and ranged from 40 to 182 feet/day, with a median value of 107 feet/day. These results are consistent with a leaky confined aquifer conceptual model.

In Table 4-3, the observation wells are sorted by the following depth intervals: shallow, intermediate, and deep. These intervals correspond to the respective extraction well screened intervals. Table 4-3 also includes the model layers screened by each well.

4.6 Distance Drawdown Analysis

To estimate the extent of the influence from the extraction wells, a distance drawdown plot was prepared using the maximum displacement caused by extraction well pumping at a time of 4,320 minutes after extraction well pumping started. The data used are listed in Table 4-4. The distance drawdown plot is shown in Figure 4-4. Separate plots were prepared for shallow, intermediate, and deep wells. In the case of the shallow wells, drawdown was less than that observed in the intermediate and deep wells because of the significant vertical distance between the screens in these wells and the extraction wells. In all three cases, the distance drawdown plot indicates the extent of influence of the three extraction wells is between 1,300 and 2,000 feet.

4.7 Well GWP-10 Test Analysis

To check the results of the analysis conducted on the extraction well test data, background monitoring period water level data from selected wells were analyzed using Aqtesolv Professional using only well GWP-10 as a pumping well. An example of the plot of the analysis of data from well SVP-10, Port 3 is show in Figure 4-5. This was done to take advantage of the influence of pumping at well GWP-10 observed in many of the observation wells. Water level data from wells GWX-10019 and EW-1D, the closest wells to well GWP-10, were reviewed to estimate when well GWP-10 was on and off. Well GWX-10019 is screened above well GWP-10 and well EW-1D is screened over a similar elevation interval as well GWP-10. A flow rate of 1,000 gpm was assigned to well GWP-10. Based on observations during the sustained yield test, well GWP-11 was assumed to run constantly at a rate of 1,200 gpm during the observation period and was, therefore, not included in the analysis. The same interval of data was selected from each observation well for analysis. This interval covered a period of about 1,000 minutes and included one cycle where pumping at well GWP-10 started and then terminated at 750 minutes. The Aqtesolv analyses are included in Appendix I and the results of these analyses are shown in Table 4-3.

The results of the analysis of the water level displacement observations during the pumping at well GWP-10 are summarized in Table 4-3. Transmissivity values ranged from 18,770 feet^2/day to 77,190 feet^2/day, with a median value of 34,470 feet^2/day. Storativity values ranged from 3.93×10^{-4} to 2.36×10^{-3}, with a median value of 1.16×10^{-3}. Using an aquifer thickness of 452 feet, K values were calculated and ranged from 42 to 171 feet/day with a median value of 76 feet/day.

When compared to the results from the extraction well analysis, the range of transmissivity and conductivity values from the extraction well and well GWP-10 analyses are similar but the median values for the well GWP-10 analyses are lower. The median transmissivity values calculated from the extraction well and well GWP-10 analyses are, respectively, 48,015 feet^2/day and 34,470 feet^2/day. The median K values calculated from the extraction well and well GWP-10 analyses are, respectively, 107 feet/day and 76 feet/day. These results are consistent with a leaky confined aquifer conceptual model. The results from the well GWP-10 and sustained yield test analysis are in general agreement. However, if the flow rate of well GWP-10 is not equal to the reported value of 1,000 gpm this would be one reason why these results differ.

In Table 4-3, the observation wells are sorted by the following depth intervals: shallow, intermediate, and deep. These intervals correspond to the respective extraction well screened intervals.

4.8 Extraction Well Pumping Influence on Monitoring Wells

Monitoring well clusters MW-1S/I, MW-2S/I, and MW-3S/I were installed to monitor the capture zone which is expected to develop after the extraction wells begin operation. The locations of the wells, shown on Figure 2-1, were chosen based on simulations of the capture zone using the groundwater flow model before the sustained yield test was conducted.

Each well cluster consists of a shallow (S) well with a 10-foot screen targeted at the -150 foot elevation and an intermediate (I) well with a 10-foot screen targeted at the -225 foot elevation (Table 4-1). These elevations correspond, respectively, to the approximate midpoint of the shallow extraction well, EW-1S, and intermediate extraction well, EW-1I, screened zones. The MW-01 cluster was installed approximately 280 feet northeast of the extraction wells and is intended to provide water level data inside the extraction well capture zone. The MW-02 cluster is located approximately 720 feet east-northeast of the extraction wells and is intended to monitor the width of the extraction well capture zone. The MW-03 cluster, located approximately 1,870 feet east-southeast of the extraction wells, is intended to provide water level data outside the capture zone of the extraction wells and Garden City supply wells GWP-10 and GWP-11.

While the 72-hour sustained yield test is not long enough to allow the full capture zone to develop, the drawdown data were checked to see if the extraction wells are influencing water levels in the monitoring wells. The water level fluctuation caused by pumping at well GPW-10 and the additional drawdown caused by extraction well pumping during the sustained yield test are clearly visible on the graph of water level data from wells MW-1S and MW-1I, which are included in Appendix F. Drawdown in well MW-1S attributable to extraction well pumping was 0.42 feet, and was observed within the first 1.5 hours of the test. Drawdown in well MW-1I attributable to extraction well pumping was 0.50 feet, and was observed within the first 1.5 hours of the test.

The water level fluctuation caused by pumping at well GPW-10 and the additional drawdown caused by extraction well pumping during the sustained yield test are also visible on the graph of water level data from wells MW-2S and MW-2I, which are included in Appendix F. However, the drawdown caused by the extraction well is significantly smaller than the drawdown in the MW-1S/I cluster. This is to be expected since this well cluster is about 2.5 times as far from the extraction wells as the well MW-1S/I cluster. Drawdown in well MW-2S attributable to extraction well pumping was 0.15 feet, and was observed within the first 1.5 hours of the test. Drawdown in well MW-2I attributable to extraction well pumping was 0.22, feet and was also observed within the first 1.5 hours of the test.

The water level fluctuation caused by pumping at well GPW-10 is clearly visible on the graph of water level data from wells MW-3S and MW-3I which are included in Appendix F. The extraction well pumping did not appear to cause any drawdown in either well MW-3S or well MW-3I. These results indicate that this well cluster should provide useful data, as intended, outside of the extraction well capture zone.

As discussed below, the sustained yield test was simulated using the groundwater flow model developed during the Feasibility Study. The results of the modeling indicate that the drawdown values simulated at well clusters MW-01S/I and MW-02S/I are in good agreement with the observed values, particularly during the cycling of GWP-10. Attached in Appendix J is the modeling technical memorandum, *Simulation of Aquifer Test and Model Refinement (April 2011),* which was prepared by CDM.

4.9 Use of the Sustained Yield Test Results in the Groundwater Flow Model

The groundwater flow model was developed and used during the Feasibility Study to simulate the capture zone of various configurations of groundwater pumping wells and flow rates. The sustained yield test was simulated using the model as an additional means (other than groundwater head) to verify the hydraulic properties originally used in the Feasibility Study. Simulated changes in groundwater head were compared to water levels observed in wells during the background monitoring, when only well GWP-10 was running, and during the sustained yield test and hydraulic properties within the model were adjusted accordingly.

The sustained yield test was initially simulated using the K values and other aquifer parameters that were used during the Feasibility Study simulations. Under this scenario, the model predicted more drawdown in wells than was observed during the sustained yield test. This indicated that the model K in some layers was too low and needed to be increased. Additional lithologic data and gamma logs that were collected during the installation of the extraction wells and following the FS were reviewed and a relatively sandy layer was identified in the middle Magothy aquifer. The lateral extent of this unit is not well defined due to a lack of data, but was estimated by correlating the lithologic log and gamma log data collected during installation of the extraction wells to other gamma logs within the study area.

The hydraulic conductivity of this sandy layer within the middle Magothy was increased from an original value of 40 feet/day to 80 feet/day. This unit is identified in Table 4-5 as the "coarse zone" in the middle Magothy aquifer. This higher K improved the match between observed and predicted drawdown. A sensitivity analysis was conducted using K values of up to 180 feet/day for this coarse zone. The K value of 180 feet/day generally provided the best fit to data from well SVP-10, close to the extraction wells, but did not significantly improve the fit to data from other wells. A value of 180 feet/day is considered very high for the Magothy based on regional data (Smolensky et al. 1989).

The K values calculated from well GWP-10 pumping and from the sustained yield test are listed in Table 4-3 along with the final K values used in the respective model layer screened by the well. Table 4-5 compares the calculated K values, the original model values, and the revised model K values. The K values calculated from well GWP-10 pumping and the sustained yield test support the use of higher K values in the groundwater flow model.

To evaluate the effect of a range of K values on the extraction well capture zone, the groundwater flow model was used to simulate three scenarios: 1) the original aquifer parameters, 2) a K value of 80 feet/day assigned to the middle Magothy coarse zone and 3) a K value of 180 feet/day assigned to the middle Magothy coarse zone. These simulations show that as hydraulic conductivity increases the capture zone narrows and lengthens. The groundwater modeling procedures and results are discussed in detail in the *Simulation of Aquifer Test and Model Refinement* technical memorandum prepared by CDM which is included as Appendix J.

Section 5
Conclusions

The sustained yield test on extraction wells EW-1S, EW-1I, and EW-1D was successful and achieved its objectives.

- Extraction wells EW-1S, EW-1I, and EW-1D have the capacity to meet their design flow requirements.
- The hydraulic conductivity values calculated based on the sustained yield test were higher than those used in the original design, therefore the capture zones created by the extraction wells may be narrower than the original design. The width of the capture zone can be increased by increasing the flow rate.
- The distance drawdown plot indicates the extent of influence of the three extraction wells pumping together is between 1,300 and 2,000 feet. The extent of influence will be greatest in the upgradient direction.
- Transmissivity values calculated from the extraction well sustained yield test ranged from 18,130 $feet^2$/day to 82,430 $feet^2$/day with a median value of 48,180 $feet^2$/day. Storativity values ranged from $3x10^{-4}$ to $1.53x10^{-3}$ with a median value of $8.15x10^{-4}$. Hydraulic conductivity values ranged from 40 to 182 feet/day with a median value of 107 feet/day.
- Transmissivity values calculated from well GWP-10 pumping data ranged from 18,770 $feet^2$/day to 77,190 $feet^2$/day with a median value of 34,470 $feet^2$/day. Storativity values ranged from $3.93x10^{-4}$ to $2.36x10^{-3}$ with a median value of $1.16x10^{-3}$. Hydraulic conductivity values ranged from 42 to 171 feet/day with a median value of 76 feet/day.
- The range of transmissivity and conductivity values calculated from the extraction well and well GWP-10 data are similar, but the median values for well GWP-10 are lower. The median transmissivity values calculated from the extraction well and well GWP-10 analyses are, respectively, 48,015 $feet^2$/day and 34,470 $feet^2$/day. The median hydraulic conductivity values calculated from the extraction well and well GWP-10 analyses are, respectively, 106 feet/day and 76 feet/day. Overall, these results are consistent with a leaky confined aquifer conceptual model.
- The baseline specific capacity data for extraction wells EW-1S , EW-1I, and EW-1D are, respectively, 17 gpm/foot of drawdown, 24 gpm/foot of drawdown, and 24 gpm/foot of drawdown. These values are derived from the sustained yield test. Higher specific capacities were calculated from the step test data. The maximum specific capacity values calculated from step test data for extraction well EW-1S, EW-1I, and EW-1D were, respectively, 24 gpm/ft of drawdown, 31 gpm/ft of drawdown, and 28 gpm/ft of drawdown. The high specific capacity and relatively small drawdown observed in the extraction wells during the sustained yield test indicate that, if necessary, the extraction wells can be pumped at a higher flow rate.

- If municipal wells GWP-10 and GWP-11 continue to pump at the rates and schedules observed during the sustained yield test, then the effect of pumping at these wells should be a constant in the aquifer system and, therefore, they should not impact the extraction well operation.

Section 6
References

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Tables

Table 2-1
Transducer Deployment Information
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well	Transducer Type	Date Installed	Sampling Rate (minutes)	Date Removed
MW-1S	In-Situ	8/4/10	10 (background),1 (during pump test)	9/20/10
MW-1I	In-Situ	8/4/10	10 (background), 1 (during pump test)	9/20/10
MW-2S	In-Situ	8/4/10	10 (background), 1 (during pump test)	9/20/10
MW-2I	In-Situ	8/4/10	10 (background), 1 (during pump test)	9/20/10
MW-3S	In-Situ	8/4/10	10	9/20/10
MW-3I	In-Situ	8/4/10	10	9/20/10
GWX-10019 (N-10019)	In-Situ	8/4/10	10 (background), 1 (during pump test)	9/20/10
GWX-10020 (N-10020)	In-Situ	8/4/10	10 (background), 1 (during pump test)	9/20/10
SVP-5, Ports 10, 8, 5, 3, and 1	Westbay MOSDAX	8/23/10	10 (background), 1 (during pump test)	9/13/10
SVP-10, Port 10, 8, 5, 3, and 1	Westbay MOSDAX	8/23/10	10 (background), 1 (during pump test)	9/13/10
EW-1S	In-Situ	8/24/10	10 (background), 1 (during pump test)	9/13/10
EW-1I	In-Situ	8/24/10	10 (background), 1 (during pump test)	9/13/10
EW-1D	In-Situ	8/24/10	10 (background), 1 (during pump test)	9/13/10
SVP-2, Port 4	In-Situ	8/24/11	10 (background),1 (during pump test)	9/13/10
SVP-3, Port 3	In-Situ	8/24/11	10 (background), 1 (during pump test)	9/13/10
SVP-4, Port 6	In-Situ	8/24/11	10 (background), 1 (during pump test)	9/13/10
SVP-9, Port 5	In-Situ	8/24/11	10 (background), 1 (during pump test)	9/13/10
SVP-11, Port 2	In-Situ	8/23/11	10	9/10/11

Table 3-1
Step and Pump Test Flow Rate Information and Specific Capacity Data
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well	Step/Phase	Multiple of Design Flow Rate	Flow Rate (gpm)	Displacement (feet)	Specific Capacity (gpm/ft of drawdown)
EW-1S	1	0.7	40	2.14	19
EW-1S	2	1	60		See note
EW-1S	3	1.3	75	3.26	23
EW-1S	4	1.5	90	3.78	24
EW-1I	1	0.7	40	1.35	30
EW-1I	2	1	60	1.91	31
EW-1I	3	1.3	75	2.4	31
EW-1I	4	1.5	90	2.97	30
EW-1D	1	0.8	60	2.45	24
EW-1D	2	1.3	100	3.9	26
EW-1D	3	1.8	140	5.46	26
EW-1D	4	2.3	180	6.53	28
EW-1S	Pump Test	1.2	70	4.06	17
EW-1I	Pump Test	1.2	70	2.90	24
EW-1D	Pump Test	1.4	110	4.53	24

Note: Experienced recovery during this step, did not calculate specific capacity

Well	Design Flow Rate (gpm)
EW-1S	60
EW-1I	60
EW-1D	80

gpm – gallons per minute

Table 3-2
Water Quality Parameters
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Location	Date and Time	Temperature (degree C)	Specific Conductance (ms/cm)	Dissolved Oxygen (mg/l)	pH (SU)	Oxidation Reduction Potential (mV)	Turbidity (NTU)
Combined Flow (from all 3 extraction wells)	9/7/10 3:00 PM	16.04	0.448	6.66	4.62	226.7	0.46
Combined Flow	9/7/10 3:05 PM	16.01	0.446	5.2	4.58	229.1	0.44
Combined Flow	9/7/10 3:10 PM	16.05	0.448	4.52	4.58	230.4	0.48
EW-1S	9/7/10 3:45 PM	17.55	0.628	6.25	4.53	228.9	0.33
EW-1S	9/7/10 3:50 PM	17.55	0.628	5.2	4.51	233.4	0.44
EW-1S	9/7/10 4:00 PM	17.52	0.626	4.68	4.49	240.5	0.48
EW-1S	9/7/10 4:10 PM	17.42	0.623	4.48	4.89	245.4	0.46
EW-1I	9/7/10 4:35 PM	16.02	0.359	5.13	4.75	216.4	0.55
EW-1I	9/7/10 4:40 PM	16.04	0.358	3.62	4.62	221.8	0.45
EW-1D	9/7/10 5:00 PM	14.65	0.334	4.36	4.21	218.2	0.41
EW-1D	9/7/10 5:05 PM	14.6	0.334	3.54	4.66	222.3	0.73
Combined Flow	9/10/10 8:10 AM	15.55	0.422	9.77	4.8	193.5	0.57
Combined Flow	9/10/10 8:15 AM	15.59	0.421	9.1	4.77	195.4	0.77
Combined Flow	9/10/10 8:20 AM	15.58	0.42	7.3	4.76	195.9	0.56
EW-1S	9/10/10 8:35 AM	16.89	0.55	9.5	4.7	196.9	0.72
EW-1S	9/10/10 8:40 AM	16.86	0.55	8.31	466	199.4	0.64
EW-1S	9/10/10 8:45 AM	16.84	0.548	7.65	4.65	201.8	0.59
EW-1S	9/10/10 8:50 AM	16.84	0.548	7.21	4.64	202.5	0.59
EW-1I	9/10/10 9:00 AM	15.68	0.345	4.87	4.78	138.4	0.6
EW-1I	9/10/10 9:05 AM	15.66	0.344	4.47	4.77	193.2	0.77
EW-1I	9/10/10 9:10 AM	15.69	0.344	4.2	4.72	192.7	0.61
EW-1D	9/10/10 9:15 AM	14.4	0.351	5.22	4.78	193.1	0.53
EW-1D	9/10/10 9:20 AM	14.41	0.35	4.51	4.77	194.5	0.81
EW-1D	9/10/10 9:25 AM	14.41	0.351	4.37	4.77	194.6	0.68
EW-1D	9/10/10 9:30 AM	14.42	0.35	4.28	4.78	194.7	0.61

Table 3-3
Manual Water Level Observations
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well ID	Date	Ground Surface Elevation (ft msl) NGVD29	Temporary Stickup (feet above ground surface)	Stickup (feet)	Sanitary Seal Thickness (feet)	DTW (feet below TIC)	Pressure Head (psi)	Height of Water Column Above the Transducer (feet)	DTW (adjusted to ground surface)	Water Level Elevation (feet amsl)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Top of Screen (feet amsl)	Bottom of Screen (feet amsl)
EW-1D	8/30/10 11:23 AM	88.12	0.5	N/A	N/A	35.98	29.59	68.32	35.48	52.64	350	410	-262	-322
EW-1D	9/7/10 9:41 AM	88.12	0.5	n/a	n/a	36.30	29.44	68.00	35.80	52.32	350	410	-262	-322
EW-1I	8/30/10 11:33 AM	88.12	0.25	n/a	n/a	35.15	29.50	68.09	34.90	53.22	280	340	-192	-252
EW-1I	9/7/10 9:47 AM	88.12	0.25	n/a	n/a	35.55	29.36	67.81	35.30	52.82	280	340	-192	-252
EW-1S	8/30/10 11:48 AM	88.12	1.05	n/a	n/a	34.21	27.65	63.82	33.16	54.96	210	270	-122	-182
EW-1S	9/7/10 9:51 AM	88.12	1.05	n/a	n/a	34.67	27.46	63.42	33.62	54.50	210	270	-122	-182
GWX-10019	8/4/10 11:28 AM	86.64	n/a	-0.33	0.04	30.64	17.79	41.07	30.97	55.67	223	228	-136	-141
GWX-10019	8/30/10 11:15 AM	86.64	n/a	-0.33	0.04	30.61	17.68	40.83	30.94	55.70	223	228	-136	-141
GWX-10019	9/7/10 9:31 AM	86.64	n/a	-0.33	0.04	31.05	17.49	40.39	31.38	55.26	223	228	-136	-141
GWX-10019	9/20/10 11:09 AM	86.64	n/a	-0.33	0.04	31.22	15.18	35.04	31.55	55.09	223	228	-136	-141
GWX-10020	8/4/10 11:57 AM	82.78	n/a	0.19	0.04	26.77	19.37	44.74	26.58	56.20	186	191	-103	-108
GWX-10020	8/30/10 10:07 AM	82.78	n/a	0.19	0.04	26.88	19.34	44.66	26.69	56.09	186	191	-103	-108
GWX-10020	9/7/10 8:52 AM	82.78	n/a	0.19	0.04	27.43	19.10	44.12	27.24	55.54	186	191	-103	-108
GWX-10020	9/20/10 11:24 AM	82.78	n/a	0.19	0.04	27.62	16.16	37.32	27.43	55.35	186	191	-103	-108
MW-1I	8/4/10 1:21 PM	86.62	n/a	-0.36	0.04	32.05	16.36	37.76	32.41	54.21	305	315	-218	-228
MW-1I	8/30/10 10:48 AM	86.62	n/a	-0.36	0.04	32.31	16.31	37.65	32.67	53.95	305	315	-218	-228
MW-1I	9/7/10 8:32 AM	86.62	n/a	-0.36	0.04	32.62	16.18	37.36	32.98	53.64	305	315	-218	-228
MW-1I	9/20/10 10:56 AM	86.62	n/a	-0.36	0.04	32.77	16.12	37.23	33.13	53.49	305	315	-218	-228
MW-1S	8/4/10 1:05 PM	86.62	n/a	-0.31	0.04	30.89	16.83	38.86	31.20	55.42	235	245	-148	-158
MW-1S	8/30/10 10:41 AM	86.62	n/a	-0.31	0.04	31.17	16.78	38.74	31.48	55.14	235	245	-148	-158
MW-1S	9/7/10 8:30 AM	86.62	n/a	-0.31	0.04	31.51	16.64	38.42	31.82	54.80	235	245	-148	-158
MW-1S	9/20/10 10:48 AM	86.62	n/a	-0.31	0.04	31.68	16.57	38.25	31.99	54.63	235	245	-148	-158
MW-2I	8/4/10 12:21 PM	87.12	n/a	-0.38	0.04	31.91	16.23	37.47	32.29	54.83	306	316	-219	-229

Table 3-3
Manual Water Level Observations
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well ID	Date	Ground Surface Elevation (ft msl) NGVD29	Temporary Stickup (feet above ground surface)	Stickup (feet)	Sanitary Seal Thickness (feet)	DTW (feet below TIC)	Pressure Head (psi)	Height of Water Column Above the Transducer (feet)	DTW (adjusted to ground surface)	Water Level Elevation (feet amsl)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Top of Screen (feet amsl)	Bottom of Screen (feet amsl)
MW-2I	8/30/10 9:06 AM	87.12	n/a	-0.38	0.04	32.11	16.20	37.41	32.49	54.63	306	316	-219	-229
MW-2I	9/7/10 8:00 AM	87.12	n/a	-0.38	0.04	32.46	16.04	37.04	32.84	54.28	306	316	-219	-229
MW-2I	9/20/10 10:32 AM	87.12	n/a	-0.38	0.04	32.62	15.98	36.9	33.00	54.12	306	316	-219	-229
MW-2S	8/4/10 12:15 PM	87.12	n/a	-0.33	0.04	30.86	16.36	37.78	31.19	55.93	236	246	-149	-159
MW-2S	8/30/10 9:08 AM	87.12	n/a	-0.33	0.04	31.09	16.35	37.74	31.42	55.70	236	246	-149	-159
MW-2S	9/7/10 7:57 AM	87.12	n/a	-0.33	0.04	31.51	16.17	37.34	31.84	55.28	236	246	-149	-159
MW-2S	9/20/10 10:20 AM	87.12	n/a	-0.33	0.04	31.71	16.07	37.12	32.04	55.08	236	246	-149	-159
MW-3I	8/4/10 10:31 AM	85.12	n/a	-0.33	0.04	25.26	17.62	40.70	25.59	59.53	304	314	-219	-229
MW-3I	8/30/10 9:29 AM	85.12	n/a	-0.33	0.04	25.55	17.53	40.49	25.88	59.24	304	314	-219	-229
MW-3I	9/7/10 7:21 AM	85.12	n/a	-0.33	0.04	25.77	17.45	40.29	26.10	59.02	304	314	-219	-229
MW-3I	9/20/10 10:00 AM	85.12	n/a	-0.33	0.04	26.02	17.34	40.04	26.35	58.77	304	314	-219	-229
MW-3S	8/4/10 10:20 AM	85.12	n/a	-0.29	0.04	24.81	15.53	35.87	25.10	60.02	234	244	-149	-159
MW-3S	8/30/10 9:31 AM	85.12	n/a	-0.29	0.04	25.13	15.43	35.64	25.42	59.70	234	244	-149	-159
MW-3S	9/7/10 7:23 AM	85.12	n/a	-0.29	0.04	25.39	15.53	35.39	25.68	59.44	234	244	-149	-159
MW-3S	9/20/10 9:44 AM	85.12	n/a	-0.29	0.04	25.65	15.22	35.16	25.94	59.18	234	244	-149	-159
SVP-2, Port 4	8/30/10 8:39 AM	90.51	0.9	-0.07	n/a	33.68	6.43	14.86	32.78	57.73	330	335	-239	-244
SVP-2, Port 4	9/7/10 9:04 AM	90.51	0.9	-0.07	n/a	34.12	6.24	14.39	33.22	57.29	330	335	-239	-244
SVP-3, Port 3	8/30/10 8:49 AM	88.29	n/a	-0.21	n/a	31.42	8.08	18.65	31.63	56.66	370	375	-282	-287
SVP-3, Port 3	9/7/10 8:21 AM	88.29	n/a	-0.21	n/a	31.35	7.90	18.24	31.56	56.73	370	375	-282	-287
SVP-4, Port 6	8/30/10 8:20 AM	89.97	0.6	-0.36	n/a	33.47	6.27	14.49	32.87	57.10	245	250	-155	-160
SVP-4, Port 6	9/7/10 9:23 AM	89.97	0.6	-0.36	n/a	33.94	6.07	14.02	33.34	56.63	245	250	-155	-160
SVP-5, Port 10	9/7/2010 10:00	86.67	n/a	n/a	n/a	n/a	n/a	n/a	27.35	59.32	45	50	42	37
SVP-5, Port 8	9/7/2010 10:00	86.67	n/a	n/a	n/a	n/a	n/a	n/a	28.56	58.11	150	155	-63	-68

Table 3-3
Manual Water Level Observations
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well ID	Date	Ground Surface Elevation (ft msl) NGVD29	Temporary Stickup (feet above ground surface)	Stickup (feet)	Sanitary Seal Thickness (feet)	DTW (feet below TIC)	Pressure Head (psi)	Height of Water Column Above the Transducer (feet)	DTW (adjusted to ground surface)	Water Level Elevation (feet amsl)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Top of Screen (feet amsl)	Bottom of Screen (feet amsl)
SVP-5, Port 5	9/7/2010 10:00	86.67	n/a	n/a	n/a	n/a	n/a	n/a	31.57	55.1	290	295	-203	-208
SVP-5, Port 3	9/7/2010 10:00	86.67	n/a	n/a	n/a	n/a	n/a	n/a	32.53	54.14	355	360	-268	-273
SVP-5, Port 1	9/7/2010 10:00	86.67	n/a	n/a	n/a	n/a	n/a	n/a	32	54.67	430	435	-343	-348
SVP-9, Port 5	8/30/10 9:53 AM	91.39	n/a	-0.47	n/a	32.51	6.61	15.26	32.98	58.41	285	290	-194	-199
SVP-9, Port 5	9/7/10 9:14 AM	91.39	n/a	-0.47	n/a	32.91	6.44	14.88	33.38	58.01	285	290	-194	-199
SVP-10, Port 10	9/7/2010 10:00	88.95	n/a	n/a	n/a	n/a	n/a	n/a	30.73	58.22	45	50	44	39
SVP-10, Port 8	9/7/2010 10:00	88.95	n/a	n/a	n/a	n/a	n/a	n/a	31.31	57.64	145	150	-56	-61
SVP-10, Port 5	9/7/2010 10:00	88.95	n/a	n/a	n/a	n/a	n/a	n/a	35.33	53.62	285	290	-196	-201
SVP-10, Port 3	9/7/2010 10:00	88.95	n/a	n/a	n/a	n/a	n/a	n/a	35.63	53.32	350	355	-261	-266
SVP-10, Port 1	9/7/2010 10:00	88.95	n/a	n/a	n/a	n/a	n/a	n/a	35.35	53.6	480	485	-391	-396
SVP-11, Port 2	8/30/10 5:35 PM	81.44	n/a	-0.34	n/a	30.48	18.71	43.21	30.82	50.62	400	405	-319	-324

n/a – not applicable
NGVD29 – National Geodetic Vertical Datum of 1929
Stickup – distance from the top of casing up (-) or down (+) to ground surface
amsl – above mean sea level
bgs – below ground surface
DTW – depth to water
msl – mean sea level, psi – pounds per square inch, TIC – top of inside casing

Table 4-1
Well Information and Aquifer Test Analysis Input Parameters
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well	Zone[1]	X	Y	Surface Elevation	Depth to Water	Depth To Water Source[2]	Top of Magothy, Elevation	Depth to Top of Magothy	Top of Raritan Clay, Elevation	Depth To Top of Raritan Clay	Aquitard Thickness	Depth to Bottom of Aquitard	Elevation of Bottom of Aquitard	Aquitard Thickness Source[3]	b (Thickness of Magothy)	d (Distance from Water Table or Top of Magothy to TOS)	d (Distance from unit top or water table to TOS)	L Screen Length,	Casing Length	Bottom of Screen	Total Well Depth	Elevation of Top of Screen	Elevation of Bottom of Screen	r(c) Inside Radius of Casing	r(w) Radius of Well
		NAD27 feet	NAD27 feet	NGVD29 feet	feet bgs		NGVD29 feet	feet bgs	NGVD29 feet	feet bgs	feet	feet bgs	NGVD29 feet		feet	feet	feet	feet	feet	feet bgs	feet bgs	feet	feet	feet	feet
EW-1S	S	2105932.027	186070.8029	88.12	30	A	1.39	86.73	-476	564	20	122	-34	1	442	88	180	60	210	270	275	-121.88	-181.88	0.33	0.33
EW-1I	I	2105927.568	186080.2383	88.12	30	A	1.41	86.71	-476	564	20	122	-34	1	442	158	250	60	280	340	345	-191.88	-251.88	0.33	0.33
EW-1D	D	2105923.039	186089.3509	88.12	30	A	1.47	86.65	-476	564	20	122	-34	1	442	228	320	60	350	410	415	-261.88	-321.88	0.33	0.33
GWP-10	D	2105573	185553	87.12	30	A	7.41	79.71	-479	566	20	122	-35	3	444	255	347	40	377	417	417	-289.88	-329.88	0.75	0.50
GWP-11	D	2105815.125	185331.8592	85.12	30	A	3.99	81.13	-479	564	20	122	-37	3	442	248	340	40	370	410	410	-284.88	-324.88	0.75	0.50
GWX-10019	S	2105876.582	185981.2593	86.64	30	A	1.77	84.87	-477	564	20	122	-35	1	442	101	193	5	223	228	228	-136.36	-141.36	0.17	0.17
GWX-10020	S	2106480.132	185775.454	82.78	27	A	0	82.78	-478	561	10	108	-25	2	453	78	159	5	186	191	191	-103	-108	0.17	0.17
MW-1S	S	2106106.468	186328.0804	86.62	27	B	6.54	80.08	-476	563	10	108	-21	2	455	127	208	10	235	245	250	-148.38	-158.38	0.17	0.17
MW-1I	I	2106083.149	186321.7465	86.62	27	B	6.48	80.14	-476	563	10	108	-21	2	455	197	278	10	305	315	320	-218.38	-228.38	0.17	0.17
MW-2S	S	2106577.529	186411.4699	87.12	27	B	0	87.12	-475	562	10	93	-6	4	469	143	209	10	236	246	251	-148.88	-158.88	0.17	0.17
MW-2I	I	2106564.064	186423.5908	87.12	27	B	0	87.12	-475	562	10	93	-6	4	469	213	279	10	306	316	321	-218.88	-228.88	0.17	0.17
MW-3S	S	2107725.893	185540.0914	85.12	27	B	4.41	80.71	-492	577	14	n/a	n/a	5	492	153	207	10	234	244	244	-148.88	-158.88	0.17	0.17
MW-3I	I	2107740.054	185546.4829	85.12	27	B	3.88	81.24	-492	577	14	n/a	n/a	5	492	223	277	10	304	314	314	-218.88	-228.88	0.17	0.17
SVP-2, Port 4	I	2106214.482	187385.7233	90.51	27	A	20.71	69.8	-465	556	n/a	n/a	n/a	6	486	260	303	5	330	335	335	-239.49	-244.49	0.08	0.17
SVP-3, Port 3	D	2106542.341	186966.0056	88.29	27	A	0.39	87.9	-474	562	10	93	-5	7	469	277	343	5	370	375	375	-281.71	-286.71	0.08	0.17
SVP-4, Port 6	S	2105820.762	186882.6896	89.97	27	A	18.66	71.31	-473	563	27	121	-31	7	442	124	218	5	245	250	250	-155.03	-160.03	0.08	0.17
SVP-5, Port 10	U	2106243.192	186039.5723	86.67	27	B	0	86.67	-476	563	10	108	-21	2	455	18	18	5	45	50	50	41.67	36.67	0.08	0.17
SVP-5, Port 8	S	2106243.192	186039.5723	86.67	27	B	0	86.67	-476	563	10	108	-21	2	455	42	123	5	150	155	150	-63.33	-68.33	0.08	0.17
SVP-5, Port 5	I	2106243.192	186039.5723	86.67	27	B	0	86.67	-476	563	10	108	-21	2	455	182	263	5	290	295	290	-203.33	-208.33	0.08	0.17
SVP-5, Port 3	D	2106243.192	186039.5723	86.67	27	B	0	86.67	-476	563	10	108	-21	2	455	247	328	5	355	360	360	-268.33	-273.33	0.08	0.17
SVP-5, Port 1	D	2106243.192	186039.5723	86.67	27	B	0	86.67	-476	563	10	108	-21	2	455	322	403	5	430	435	435	-343.33	-348.33	0.08	0.17
SVP-9, Port 5	I	2105956.767	187687.257	91.39	27	A	20.41	70.98	-460	551	10	119	-28	7	432	166	258	5	285	290	290	-193.61	-198.61	0.08	0.17
SVP-10, Port 10	U	2105899.137	186072.6754	88.95	30	A	1.67	87.28	-476	565	20	122	-33	1	443	15	15	5	45	50	50	43.95	38.95	0.08	0.17
SVP-10, Port 8	S	2105899.137	186072.6754	88.95	30	A	1.67	87.28	-476	565	20	122	-33	1	443	23	115	5	145	150	150	-56.05	-61.05	0.08	0.17
SVP-10, Port 5	I	2105899.137	186072.6754	88.95	30	A	1.67	87.28	-476	565	20	122	-33	1	443	163	255	5	285	290	290	-196.05	-201.05	0.08	0.17
SVP-10, Port 3	D	2105899.137	186072.6754	88.95	30	A	1.67	87.28	-476	565	20	122	-33	1	443	228	320	5	350	355	355	-261.05	-266.05	0.08	0.17
SVP-10, Port 1	D	2105899.137	186072.6754	88.95	30	A	1.67	87.28	-476	565	20	122	-33	1	443	358	450	5	480	485	485	-391.05	-396.05	0.08	0.17
SVP-11, Port 2	D	2105597.034	184603.9355	81.44	30	A	3.45	77.99	-485	566	33	177	-96	7	389	223	370	5	400	405	405	-318.56	-323.56	0.08	0.17
														Mean	452										

Note:
1. U- upper, S = shallow, I = intermediate, D = deep
2. All water level data collected in September 2010. A = SVP-10, Port 10; B = SVP-5, Port 10
3. Aquitard Thickness Data Sources: 1: Aquitard thickness data from TB-1 boring log, 2: Aquitard thickness data from SVP-5 gamma log, 3: Aquitard thickness data from TB-1 boring log, 4:SVP-03 gamma log, 5: No data available, assumed value of 14 feet
6: No aquitard observed in data, 7:Gamma log

bgs – below ground surface
NAD27 – North American Datum of 1927; NGVD29 – National Geodetic Vertical Datum of 1929
n/a - not applicable

Table 4-2
Model Layer and Aquifer Test Well Screen Information
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Well	Zone[1]	Surface Elevation	Top of Screen	Bottom of Screen	Elevation of Top of Screen	Elevation of Bottom of Screen	Model Layer Screened By Well	Elevation of Top of Model Layer	Model Layer Screened By Well	Elevation of Top of Model Layer	Model Layer Screened By Well	Elevation of Top of Model Layer	Elevation of Bottom of Deepest Model Layer Screened by Well	Model Layer Description
		NGVD29 feet	feet bgs	feet bgs	feet	feet		NGVD29 feet		NGVD29 feet		NGVD29 feet	NGVD29 feet	
EW-1S	S	88.12	210	270	-121.88	-181.88	11	-101	10	-145			-189	Middle Magothy
EW-1I	I	88.12	280	340	-191.88	-251.88	9	-189	8	-215	7	-241	-268	Middle Magothy
EW-1D	D	88.12	350	410	-261.88	-321.88	7	-241	6	-268	5	-294	-333	Middle Magothy
GWP-10	D	87.12	377	417	-289.88	-329.88	6	-269	5	-295			-335	Middle Magothy
GWP-11	D	85.12	370	410	-284.88	-324.88	6	-270	5	-296			-336	Middle Magothy
GWX-10019	S	86.64	223	228	-136.36	-141.36	11	-101					-145	Middle Magothy
GWX-10020	S	82.78	186	191	-103	-108	11	-101					-146	Middle Magothy
MW-1S	S	86.62	235	245	-148.38	-158.38	10	-144					-188	Middle Magothy
MW-1I	I	86.62	305	315	-218.38	-228.38	8	-214					-241	Middle Magothy
MW-2S	S	87.12	236	246	-148.88	-158.88	10	-145					-189	Middle Magothy
MW-2I	I	87.12	306	316	-218.88	-228.88	8	-215					-242	Middle Magothy
MW-3S	S	85.12	234	244	-148.88	-158.88	10	-147					-194	Middle Magothy
MW-3I	I	85.12	304	314	-218.88	-228.88	9	-194	8	-220			-247	Middle Magothy
SVP-2, Port 4	I	90.51	330	335	-239.49	-244.49	7	-237					-264	Middle Magothy
SVP-3, Port 3	D	88.29	370	375	-281.71	-286.71	6	-266					-292	Middle Magothy
SVP-4, Port 6	S	89.97	245	250	-155.03	-160.03	10	-142					-184	Middle Magothy
SVP-5, Port 10	U	86.67	45	50	41.67	36.67	14	86.67					13	Upper Glacial
SVP-5, Port 8	S	86.67	150	155	-63.33	-68.33	12	0					-101	Upper Magothy
SVP-5, Port 5	I	86.67	290	295	-203.33	-208.33	9	-190					-216	Middle Magothy
SVP-5, Port 3	D	86.67	355	360	-268.33	-273.33	6	-268					-295	Middle Magothy
SVP-5, Port 1	D	86.67	430	435	-343.33	-348.33	4	-334					-373	Middle Magothy
SVP-9, Port 5	I	91.39	285	290	-193.61	-198.61	9	-181					-208	Middle Magothy
SVP-10, Port 10	U	88.95	45	50	43.95	38.95	14	88.95					25	Upper Glacial
SVP-10, Port 8	S	88.95	145	150	-56.05	-61.05	12	1.7					-100	Upper Magothy
SVP-10, Port 5	I	88.95	285	290	-196.05	-201.05	9	-188					-215	Middle Magothy
SVP-10, Port 3	D	88.95	350	355	-261.05	-266.05	7	-241					-268	Middle Magothy
SVP-10, Port 1	D	88.95	480	485	-391.05	-396.05	3	-373					-476	Basal Magothy
SVP-11, Port 2	D	81.44	400	405	-318.56	-323.56	5	-297					-338	Middle Magothy

1. U – upper, S = shallow, I = intermediate, D = deep
2. Shading indicates the well did not penetrate model layer.

Table 4-3
Aquifer Test Analysis Results
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Observation Well	Zone (1)	Model Layer (2)	Pumping Well	Transmissivity, T [feet^2/day]	Storativity, S	Hydraulic Conductivity, K (feet/day)	Model	Method	Pumping Well	T [ft^2/day]	Storativity, S	K (ft/day)	Method	Aquifer Property Code	Model Horizontal K (Vertical K) Values (5)	Model Storativity, S (Specific Yield, S_y)
EW-1S	S	11, 10	EW-1S, step test	27,160	5.58E-04	**60**	Leaky Confined (LC)	Hantush-Jacob (HJ)						348	**40 (0.7)**	2E-06 (0.15)
EW-1I	I	9, 8, 7	EW-1I, step test	57,850	1.61E-02	**128**	LC	HJ						350	**80 (2)**	2E-06 (0.15)
EW-1D	D	7, 6, 5	EW-1D, step test	38,580	2.46E-01	**85**	LC	HJ						350	**80 (2)**	2E-06 (0.15)
GWP-10 & Multiple Wells (3) Distance Drawdown									GWP-10	38,860	6.59E-04	**86**	HJ	Not Applicable		
Multiple Wells*			EW-1S, I, D and GWP-10						GWP-10	32,610	1.30E-03	**72**	HJ	Not Applicable		
GWX-10019	S	11	EW-1S, I, D and GWP-10	48,660	6.81E-04	**108**	LC	HJ	GWP-10	29,680	9.77E-04	**66**	HJ	348	**40 (0.7)**	2E-06 (0.15)
GWX-10020	S	11	EW-1S, I, D and GWP-10	74,640	7.25E-04	**165**	LC	HJ	GWP-10	36,880	1.14E-03	**82**	HJ	348	**40 (0.7)**	2E-06 (0.15)
MW-1S	S	10	EW-1S, I, D and GWP-10	60,510	3.00E-04	**134**	LC	HJ	GWP-10	34,470	7.68E-04	**76**	HJ	348	**40 (0.7)**	2E-06 (0.15)
MW-2S	S	10	EW-1S, I, D and GWP-10	46,310	1.02E-03	**102**	Unconfined (U)	Neuman	GWP-10	18,770	1.63E-03	**42**	Neuman	348	**40 (0.7)**	2E-06 (0.15)
MW-3S	S	10	EW-1S, I, D and GWP-10	20,500	4.11E-04	**45**	U	Neuman	GWP-10	(4)				348	**40 (0.7)**	2E-06 (0.15)
SVP-4, Port 6	S	10	EW-1S, I, D and GWP-10	18,130	8.57E-04	**40**	U	Neuman	GWP-10	20,600	1.06E-03	**46**	Neuman	348	**40 (0.7)**	2E-06 (0.15)
SVP-10, Port 8	S	12	EW-1S, I, D and GWP-10	20,360	3.18E-04	**45**	U	Neuman	GWP-10	77,190	2.34E-03	**171**	HJ	349	**60 (0.6)**	2E-06 (0.15)
EW-1I	I	9, 8, 7	EW-1S, I, D and GWP-10						GWP-10	28,560	9.50E-04	**63**		350	**80 (2)**	2E-06 (0.15)
MW-1I	I	8	EW-1S, I, D and GWP-10	48,180	7.95E-04	**107**	LC	HJ	GWP-10	33,270	1.34E-03	**74**	HJ	350	**80 (2)**	2E-06 (0.15)
MW-2I	I	8	EW-1S, I, D and GWP-10	50,280	1.02E-03	**111**	LC	HJ	GWP-10	41,220	1.16E-03	**91**	HJ	350	**80 (2)**	2E-06 (0.15)
MW-3I	I	9, 8	EW-1S, I, D and GWP-10	47,850	9.83E-04	**106**	LC	HJ	GWP-10	(4)				348	**40 (0.7)**	2E-06 (0.15)
SVP-10, Port 5	I	9	EW-1S, I, D and GWP-10	42,170	3.00E-04	**93**	LC	HJ	GWP-10	27,560	3.93E-04	**61**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-2, Port 4	I	7	EW-1S, I, D and GWP-10	66,800	1.53E-03	**148**	LC	HJ	GWP-10	37,880	1.33E-03	**84**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-9, Port 5	I	9	EW-1S, I, D and GWP-10	82,430	1.42E-03	**182**	LC	HJ	GWP-10	38,140	9.57E-04	**84**	HJ	350	**80 (2)**	2E-06 (0.15)
EW-1D	D	7, 6, 5	EW-1S, I, D and GWP-10						GWP-10	37,360	2.36E-03	**83**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-3, Port 3	D	6	EW-1S, I, D and GWP-10	55,430	1.38E-03	**123**	LC	HJ	GWP-10	38,810	1.37E-03	**86**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-10, Port 3	D	7	EW-1S, I, D and GWP-10	49,260	1.32E-03	**109**	LC	HJ	GWP-10	37,020	2.16E-03	**82**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-10, Port 1	D	3	EW-1S, I, D and GWP-10	41,330	8.35E-04	**91**	LC	HJ	GWP-10	28,180	1.85E-03	**62**	HJ	332	**80 (1.2)**	2E-06 (0.15)
SVP-11, Port 2	D	5	EW-1S, I, D and GWP-10	36,000	4.34E-04	**80**	LC	HJ	GWP-10	22,800	8.82E-04	**50**	HJ	350	**80 (2)**	2E-06 (0.15)
SVP-5, Port 8		12	EW-1S, I, D and GWP-10	(4)						(4)				349	**60 (0.6)**	2E-06 (0.15)
SVP-5, Port 5		9	EW-1S, I, D and GWP-10	(4)						(4)				350	**80 (2)**	2E-06 (0.15)
SVP-5, Port 3		6	EW-1S, I, D and GWP-10	(4)						(4)				350	**80 (2)**	2E-06 (0.15)
SVP-5, Port 1		4	EW-1S, I, D and GWP-10	(4)						(4)				348	**40 (0.7)**	2E-06 (0.15)
	Minimum			18,130	3.00E-04	**40**				18,770	3.93E-04	**42**			**40**	
	Maximum			82,430	1.53E-03	**182**				77,190	2.36E-03	**171**			**80**	
	Median			48,180	8.15E-04	**107**				34,470	1.16E-03	**76**				

(1) Shallow (S), Intermediate (I), Deep (D),
(2) Model layers in depth order from shallow to deep
(3) Multiple Wells: EW-1S, EW-1I, EW-1D, GWX-10019, GWX-10020, MW-1S, MW-1I, MW-2I, SVP-3-Port 3, SVP-4, Port 6, SVP-10-Port 1, SVP-10-Port 3, SVP-10-Port 5, SVP-11-Port 2
(4) Data not available during observation period
(5) K values checked in model elements within 100 feet of well

Table 4-4
Distance Drawdown Data for Extraction Well and Well GWP-10 Pumping
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Shallow Zone			
Time (1) (min)	Well	Radial Distance (ft) from EW cluster	Displacement (ft)
4320	GWX-10019	111	0.78
4320	MW-1S	306	0.53
4320	MW-2S	729	0.27
4320	SVP-4, Port 6	810	0.26
Intermediate Zone			
Time (min)	Well	Radial Distance (ft) from EW cluster	Displacement (ft)
4320	SVP-10, Port 5	91	1.37
4320	MW-1I	287	0.61
4320	SVP-5, Port 5	318	0.55
4320	MW-2I	723	0.34
4320	SVP-2, Port 4	1336	0.13
4320	SVP-9, Port 5	1600	0.08
Deep Zone			
Time (min)	Well	Radial Distance (ft) from EW cluster	Displacement (ft)
4320	SVP-10, Port 3	91	1.36
4320	SVP-5, Port 3	318	0.64
4320	SVP-3, Port 3	1080	0.19

(1) Time since start of extraction well pumping

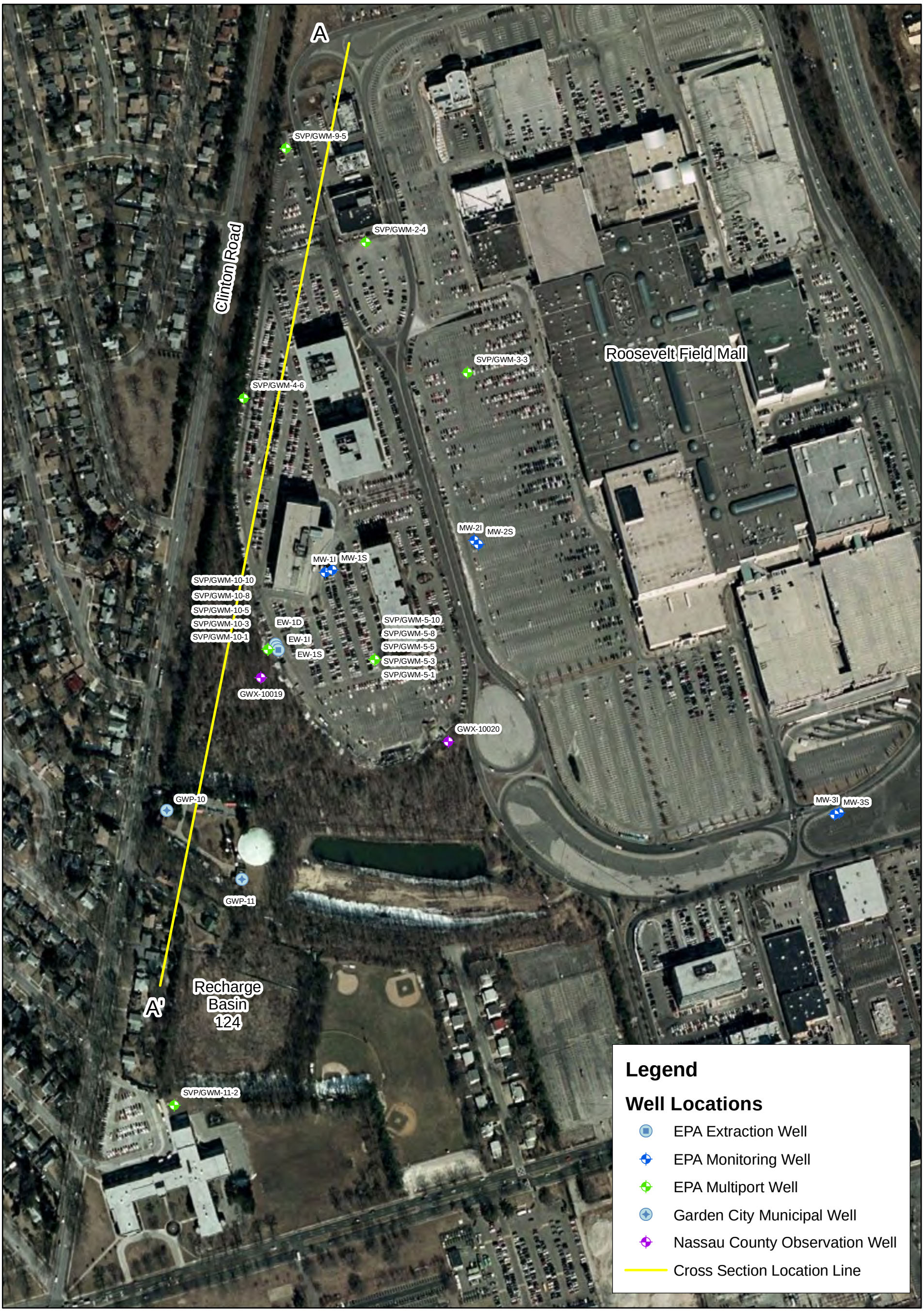
Table 4-5
Comparison of Aquifer Test Analysis Results and Model Layer K Values
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

Observation Well	Model Layer	Aquifer Unit	K (feet/day) Step Test and EW's and GWP-10 Pumping	K (feet/day) GWP-10 Pumping	Original Model Horizontal K (Vertical K)	Revised Model Horizontal K (Vertical K)
SVP-10, Port 8	12	Upper Magothy	45	171	35 (0.6)	60 (0.6)
EW-1S	11, 10	Middle Magothy	60		40 (0.7)	40 (0.7)
GWX-10019	11	Middle Magothy	108	66	40 (0.7)	40 (0.7)
GWX-10020	11	Middle Magothy	165	82	40 (0.7)	40 (0.7)
MW-1S	10	Middle Magothy	134	76	40 (0.7)	40 (0.7)
MW-2S	10	Middle Magothy	102	42	40 (0.7)	40 (0.7)
MW-3S	10	Middle Magothy	45		40 (0.7)	40 (0.7)
SVP-4, Port 6	10	Middle Magothy	40	46	40 (0.7)	40 (0.7)
EW-1I	9, 8, 7	Middle Magothy, Coarse Zone	128	63	n/a	80 (2)
MW-3I	9, 8	Middle Magothy	106		40 (0.7)	40 (0.7)
SVP-10, Port 5	9	Middle Magothy, Coarse Zone	93	61	n/a	80 (2)
SVP-9, Port 5	9	Middle Magothy, Coarse Zone	182	84	n/a	80 (2)
MW-1I	8	Middle Magothy, Coarse Zone	107	74	n/a	80 (2)
MW-2I	8	Middle Magothy, Coarse Zone	111	91	n/a	80 (2)
EW-1D	7, 6, 5	Middle Magothy, Coarse Zone	85	83	n/a	80 (2)
SVP-2, Port 4	7	Middle Magothy, Coarse Zone	148	84	n/a	80 (2)
SVP-10, Port 3	7	Middle Magothy, Coarse Zone	109	82	n/a	80 (2)
SVP-3, Port 3	6	Middle Magothy, Coarse Zone	123	86	n/a	80 (2)
SVP-11, Port 2	5	Middle Magothy, Coarse Zone	80	50	n/a	80 (2)
SVP-10, Port 1	3	Basal Magothy	91	62	60 (1.2)	80 (1.2)

Blank cell: data not available or usable for analysis.
n/a – not applicable, Middle Magothy, coarse zone was added to the model based on aquifer test results

Figures

IMS\GIS\Roosevelt\MXD\Figure_2-1_Pump_Test_Well_Location_Map.mxd



300 150 0 300 Feet

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Figure 2-1
Sustained Yield Test
Monitoring and Pumping Well Location Map
Old Roosevelt Field Contaminated Groundwater Area
Superfund Site
Garden City, New York

CDM

Figure 2-2
Geologic and Groundwater Flow Model Cross Section
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

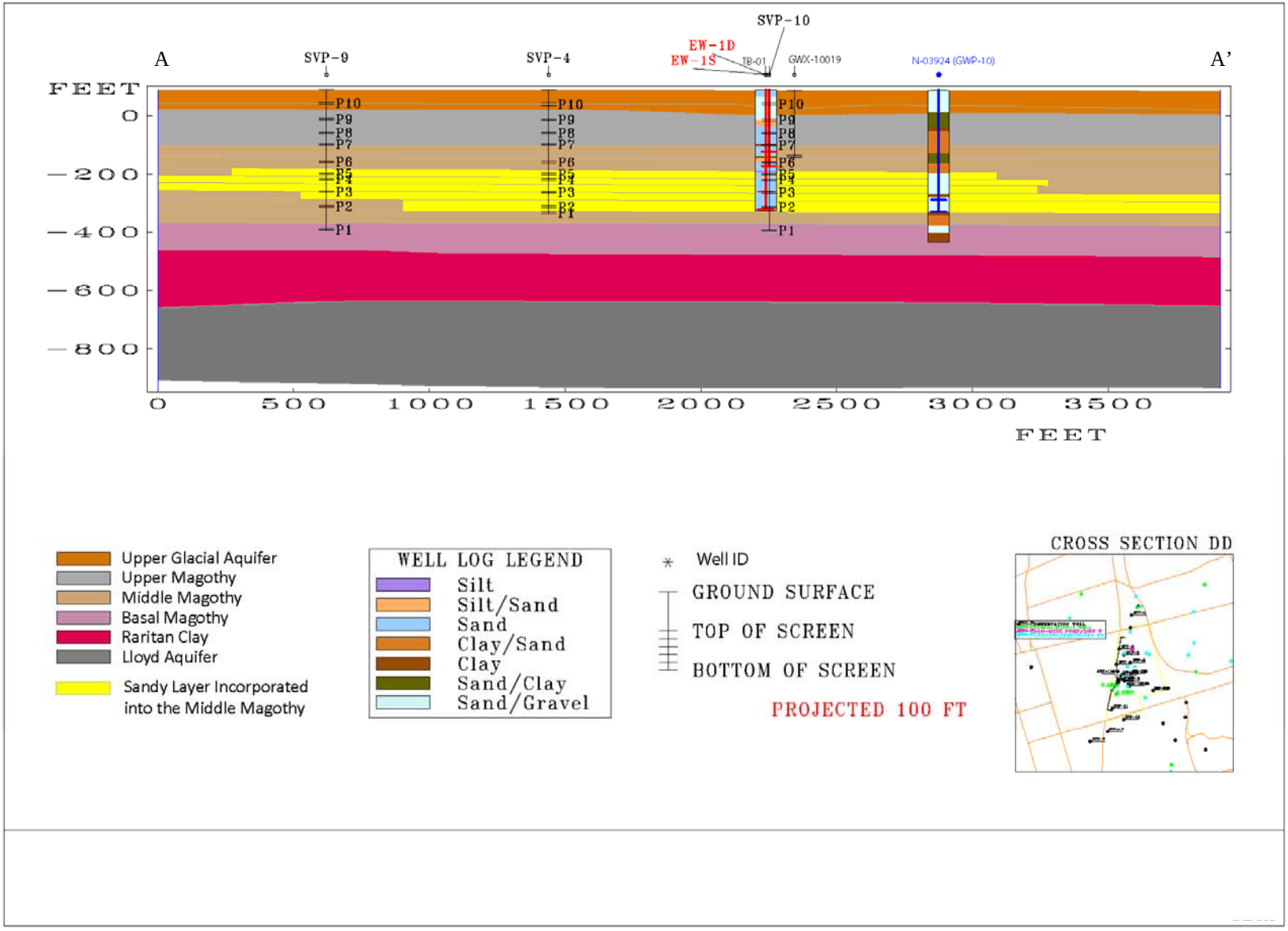


Figure 4-1
Well SVP-10 Water Level Data
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

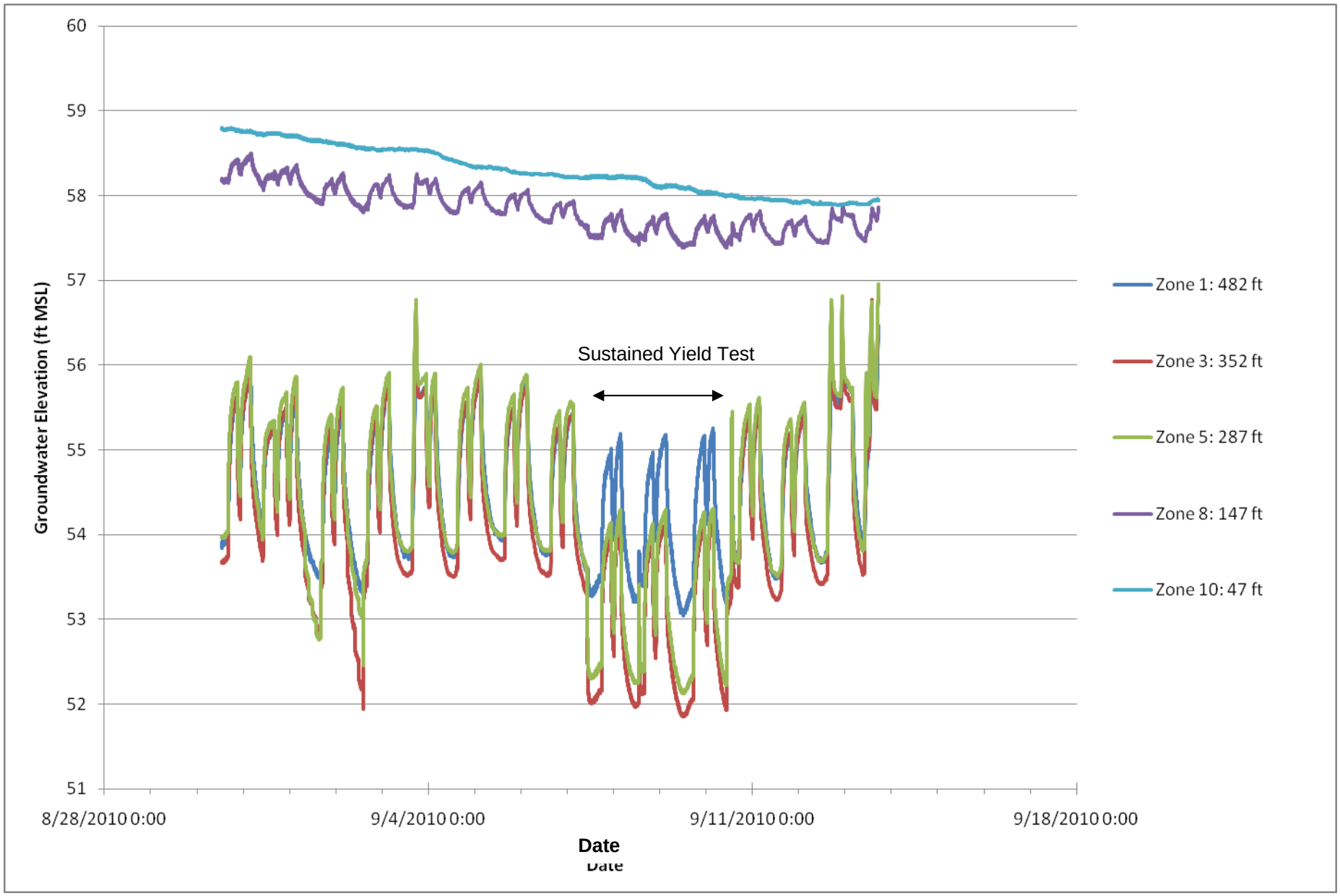


Figure 4-2
Well EW-1I Step Test Water Level Data
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

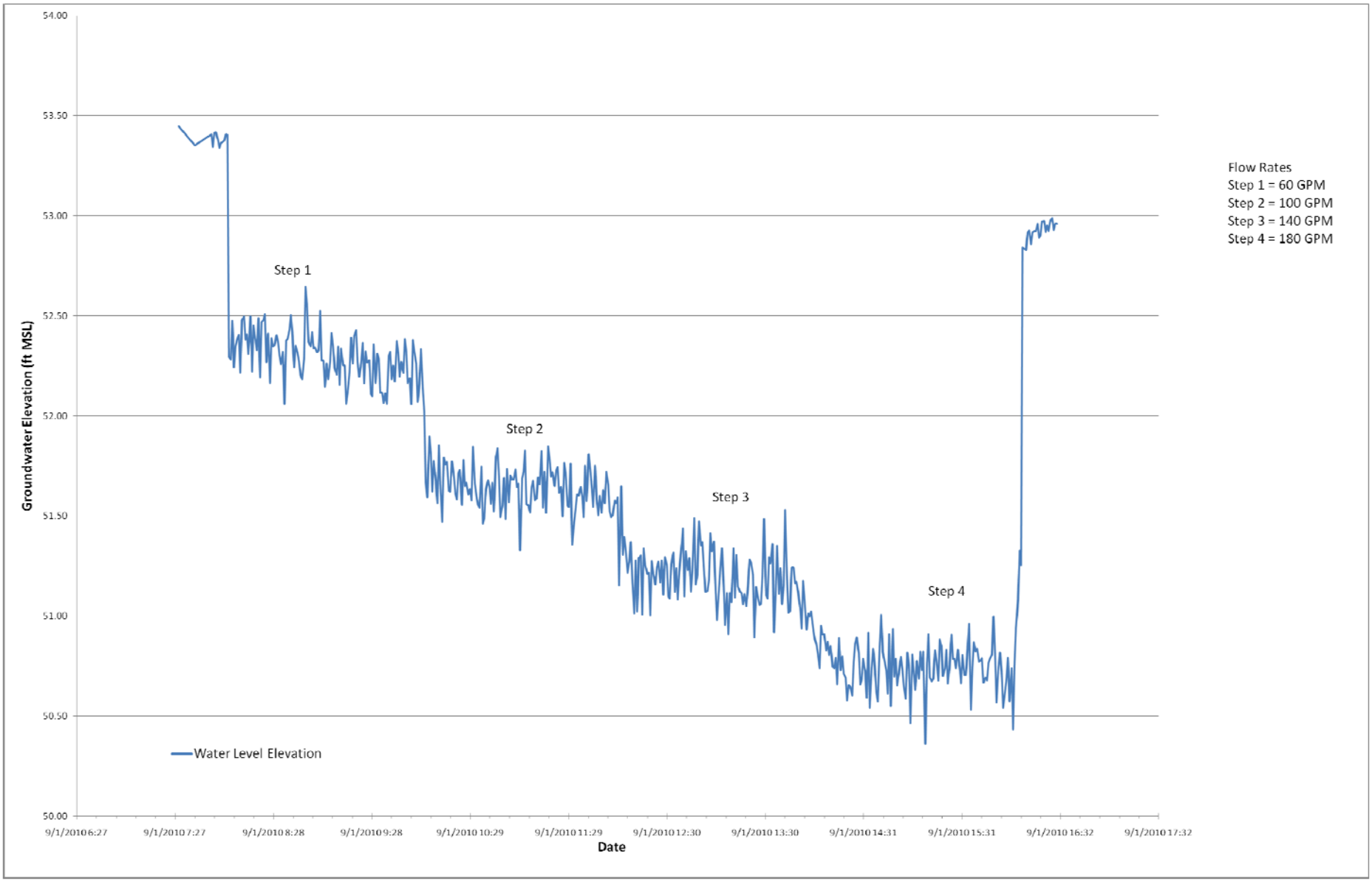


Figure 4-3
Well SVP-10, Port 3 Data Analysis: Extraction Well Pumping
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

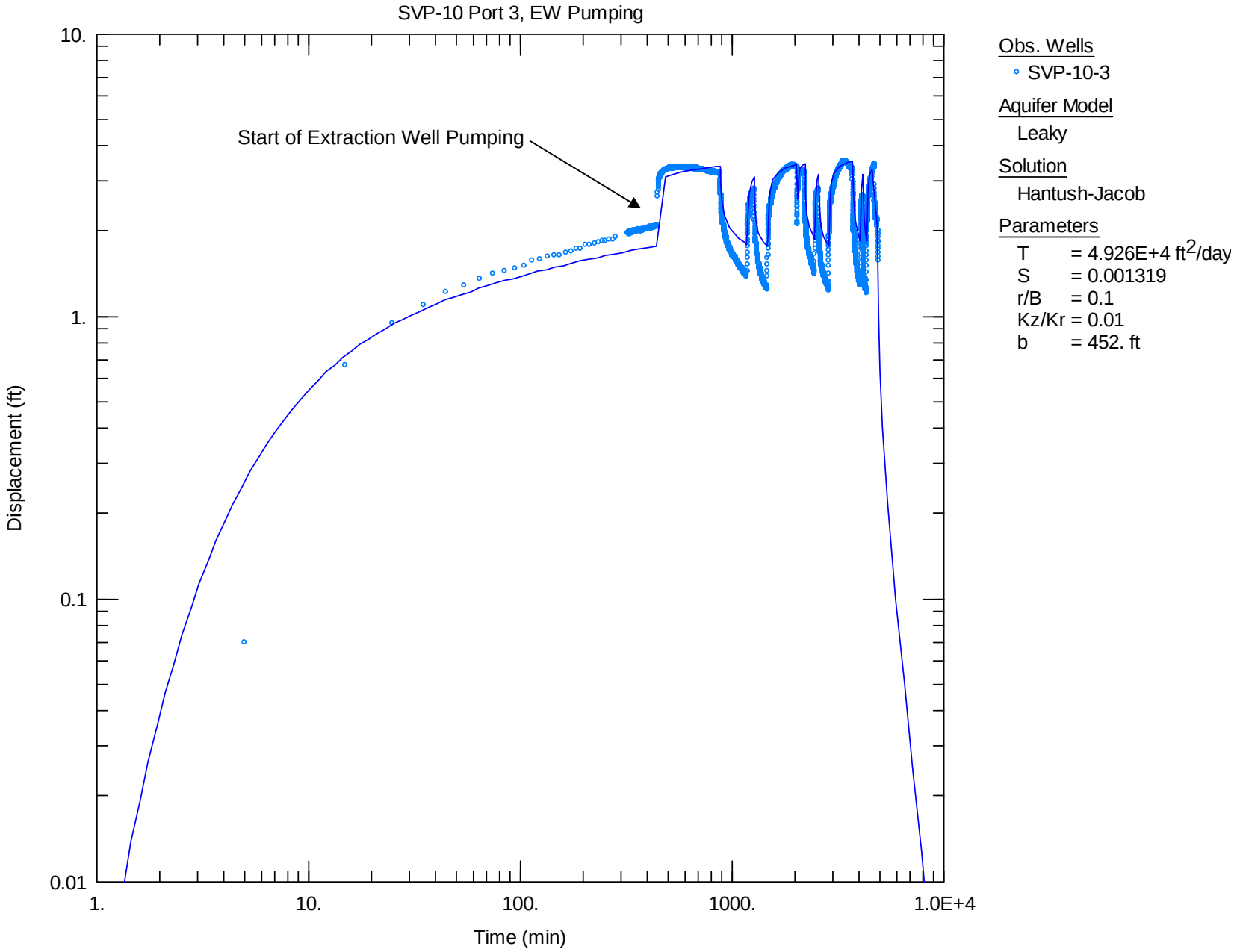


Figure 4-4
Distance Drawdown Graph: Extraction Well Pumping
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York

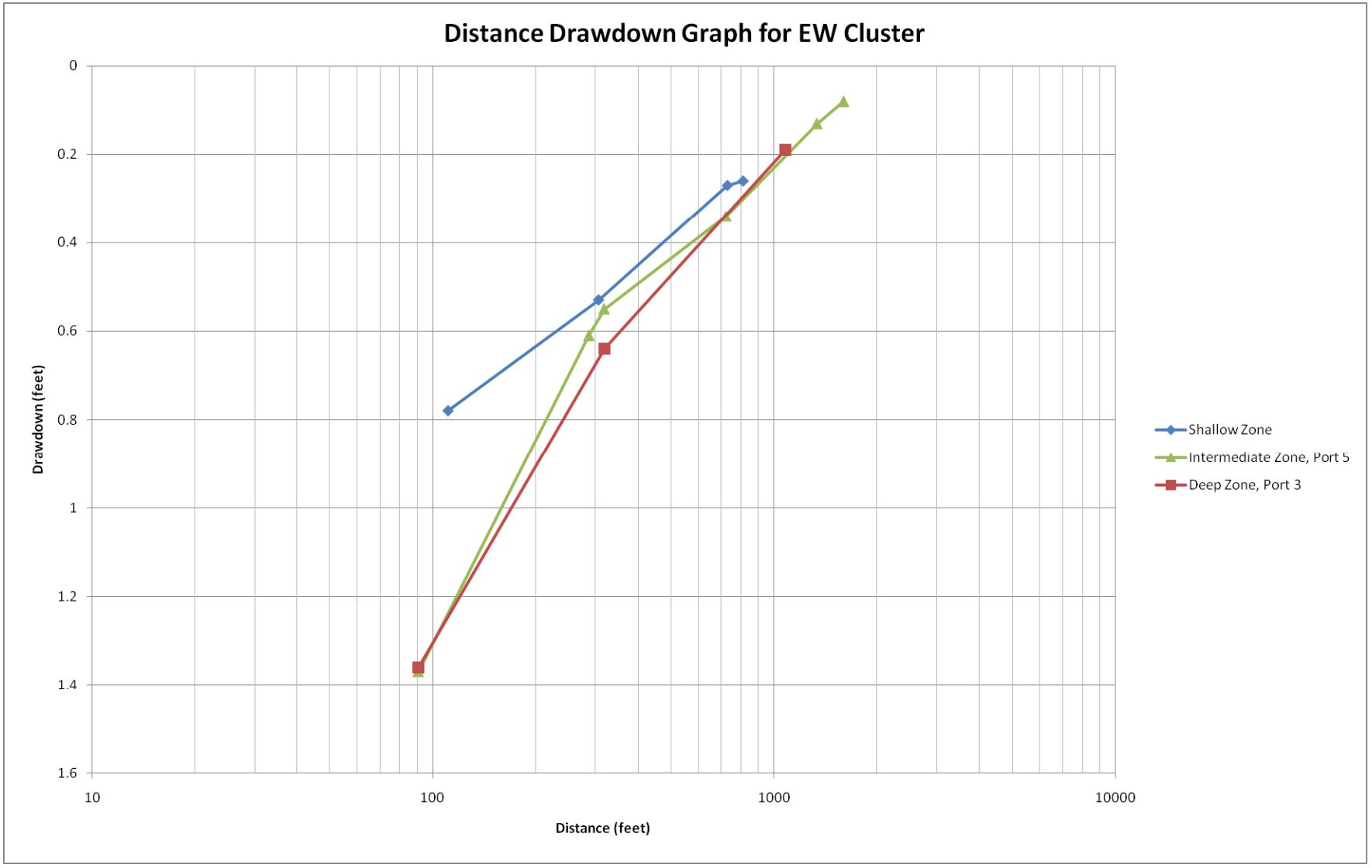
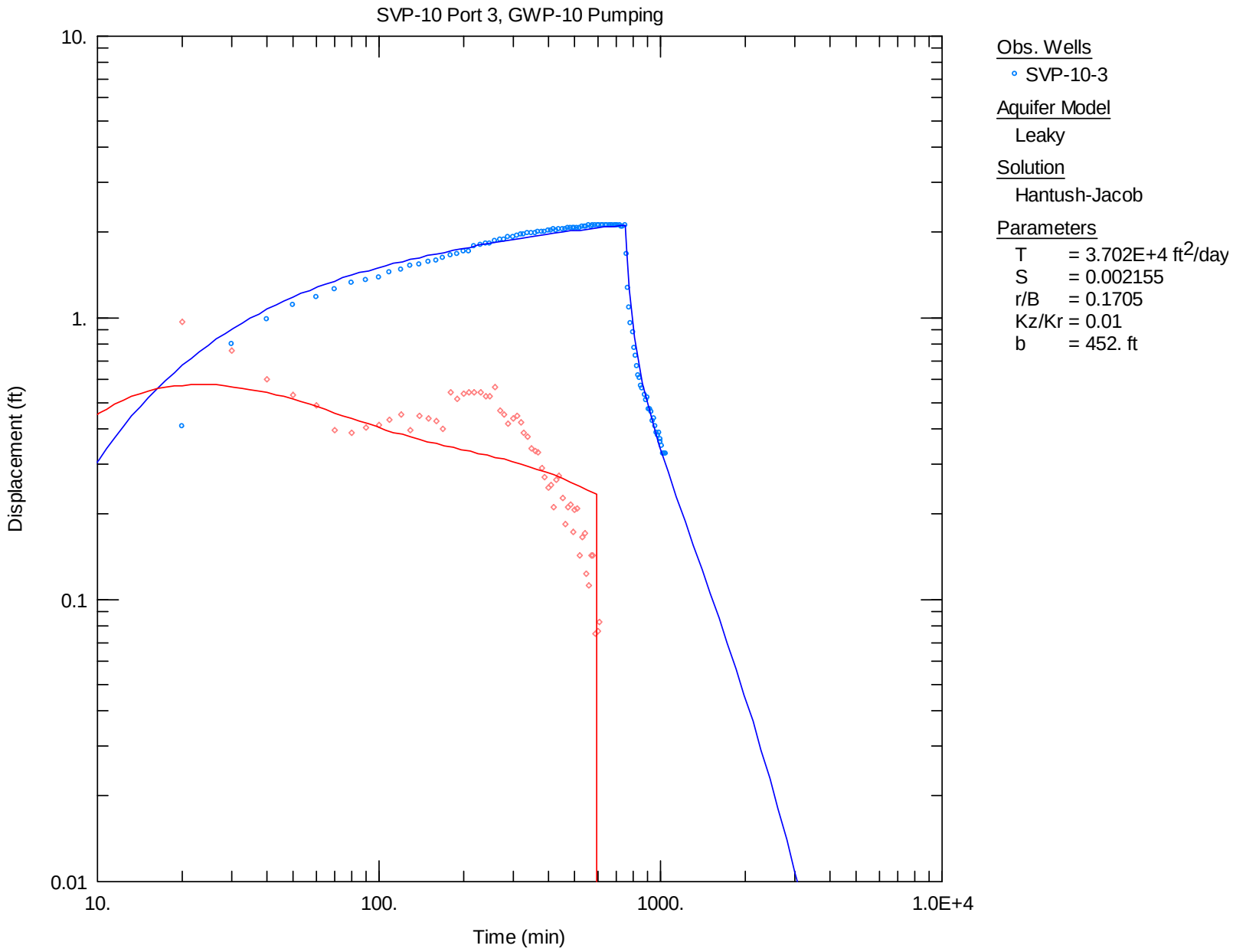


Figure 4-5
Well SVP-10, Port 3 Data Analysis: Well GWP-10 Pumping
Old Roosevelt Field Contaminated Groundwater Area Superfund Site
Garden City, New York



Appendix A

SVP-05 and SVP-10 Transducer Deployment Information

Schlumberger WATER SERVICES

MOSDAX Probe String
Installation Field Record

Project: CDM - Roosevelt Fld 2 Well No: SUP-5 By: GS
Client: CDM Location: Roosevelt Fld 2 Date: 8/23/10

Installation Data

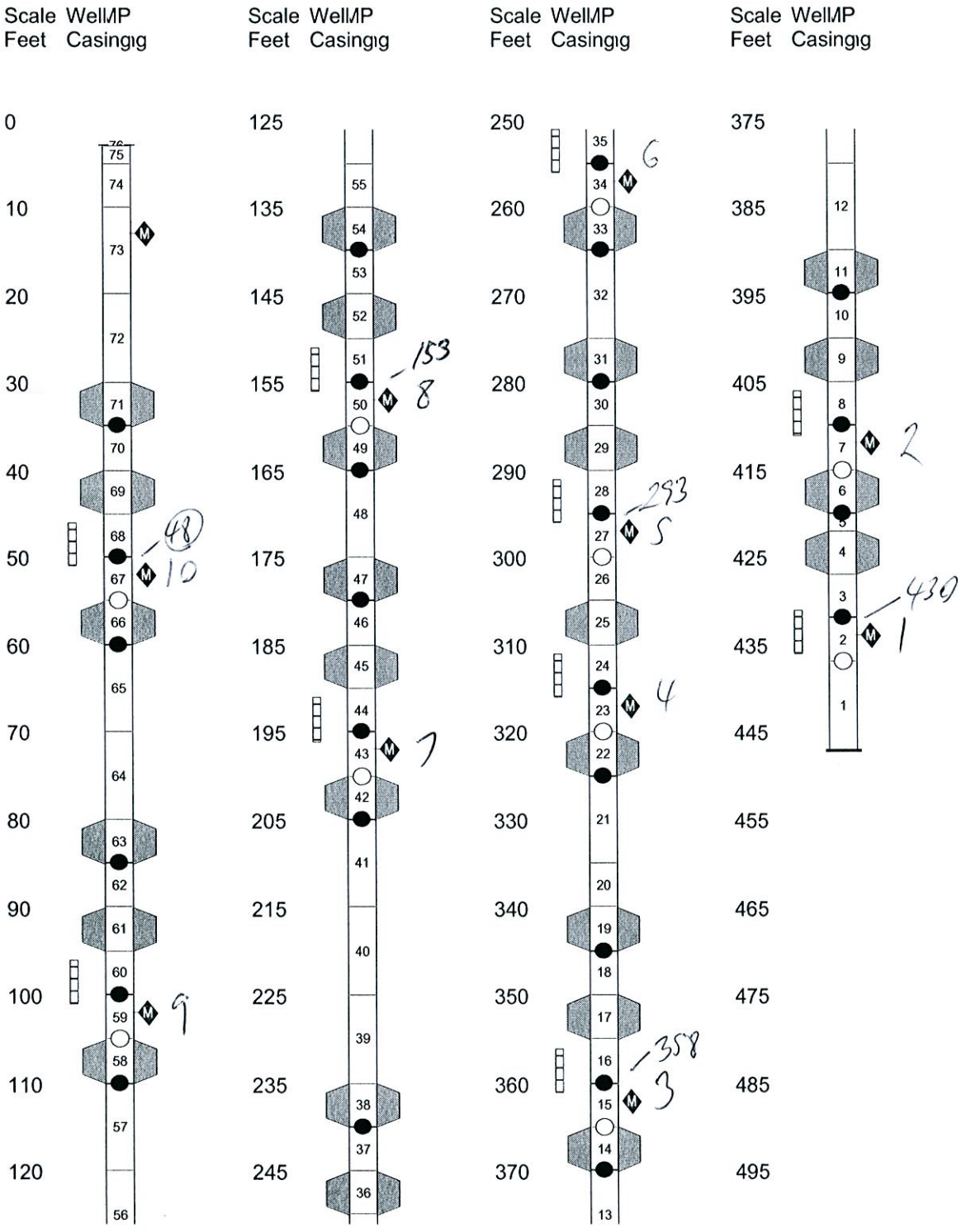
Port No.	Zone No.	Nom. Depth ( )	Collar Depth ( )	Cable No.	Cable Length ( )	Probe No.	Probe S/N	Prev. Press. Data (Po, psia)	Pi Inside Westbay (psia)	Po Outside Westbay (psia)
0	–	–	–			0	3575	–	–	–
1		430				1	3952	187.58	189.17	187.71
				3-1	72.0					
3		358				2	2200	156.12	158.05	156.46
				5-3	65.0					
5		293				3	2585	128.27	129.96	128.56
				8-5	140.0					
8		153				4	3017	68.85	69.34	68.90
				10-8	105.0					
10		48				5	2606	23.74	23.89	23.55
				0-10	68.0					

Datalogging Settings

Schedule		MAGI Settings	
Scan Rate:		Power Save:	
Collect Rate:		Beeper:	
Start Time:		External Power:	

Casing Installation Log
Aquifer Drilling & Testing, Inc.

Job No: WB845
Well: SVP--05



Mon May 05 14:52:22 2008

Fabrication of MOSDAX 2518 Probe Cables
Assembly Record and Acceptance Tests

Client: CDM Borehole No.: SVP-5 No. of Probes: 5 Depth: 446 ft Project No.: WB845

Port No.	Nom. Port Depth (ft)	Cable ID No.	Nominal Length (ft)	Cable Type	Top Assembly			Bottom Assembly			Continuity Tests			Final Length (ft)	Final Accept
					# Strands	Adhesive	Connector	# Strands	Adhesive	Connector	A = Center	B = Armor	A to B		
		0-10	68.00												
10	48														
		10-8	105.00												
8	153														
		8-5	140.00												
5	293														
		5-3	65.00												
3	358														
		3-1	72.00												
1	430														
			(430.00)												
			-												
			-												
			-												

Signed:_____ Date:_____

Schlumberger WATER SERVICES

MOSDAX Probe String
Installation Field Record

Project: CDM - Roosevelt Field Well No: SUP-10 By: CS
Client: CDM Location: Roosevelt Field Date: 8/23/12

Installation Data

Port No.	Zone No.	Nom. Depth ( )	Collar Depth ( )	Cable No.	Cable Length ( )	Probe No.	Probe S/N	Prev. Press. Data (Po, psia)	Pi Inside Westbay (psia)	Po Outside Westbay (psia)
0							3414	-		14.62
1		482				1	3951	208.46	211.27	209.04
				3-1	130'					
3		352				2	2532	152.08	154.89	152.70
				5-3	65'					
5		287				3	2433	124.02	126.72	124.68
				8-5	140'					
8		147				4	1783	64.96	66.12	65.05
				10-8	100'				22.76	
10		47'				5	2593	21.83	~~65.0~~	21.65
				0-10	67'					

Datalogging Settings

Schedule		MAGI Settings	
Scan Rate:		Power Save:	
Collect Rate:		Beeper:	
Start Time:		External Power:	

Fabrication of MOSDAX 2518 Probe Cables
Assembly Record and Acceptance Tests

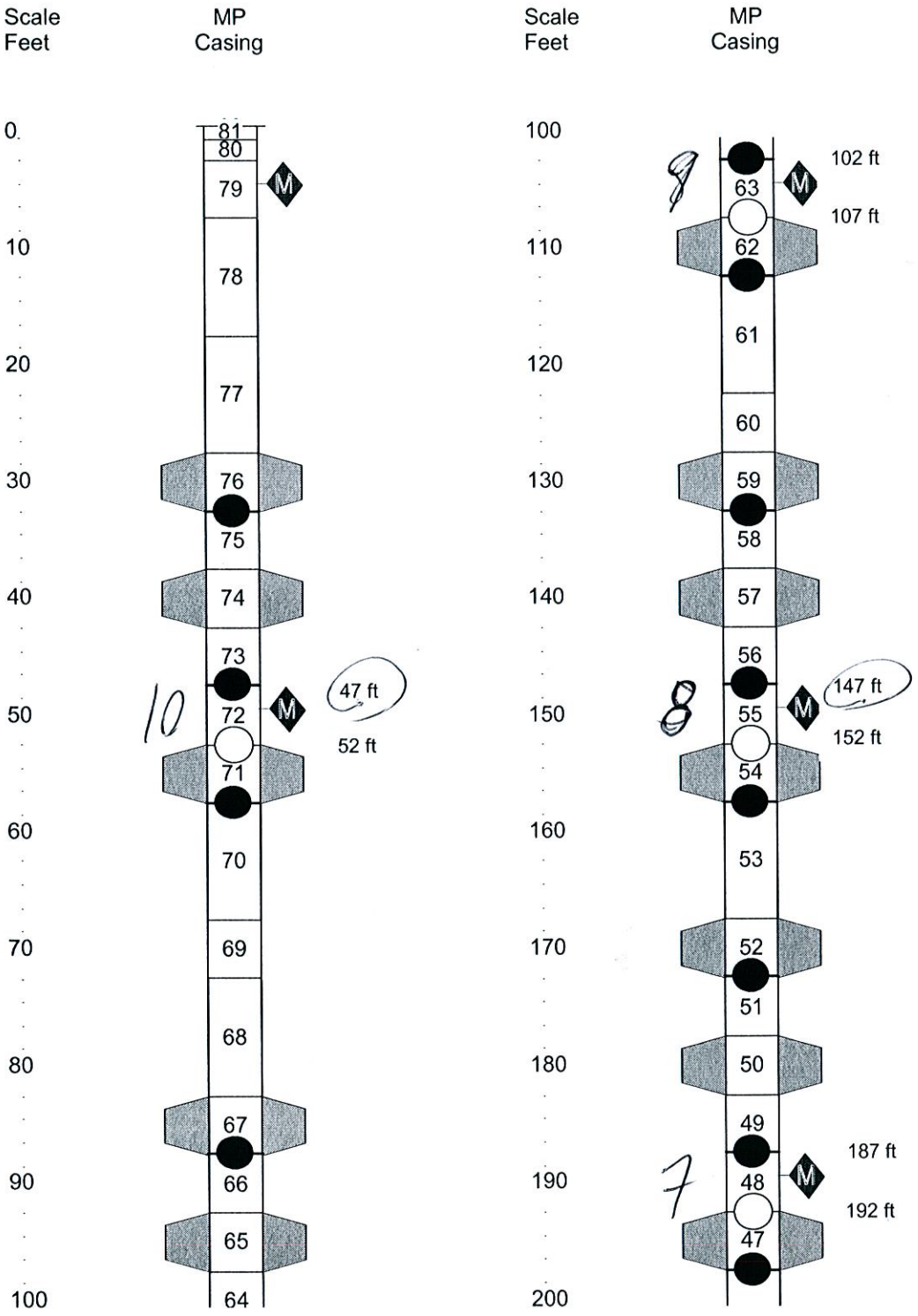
Client: CDM Borehole No.: SVP-10 No. of Probes: 5 Depth: 497 ft Project No.: WB845

Port No.	Nom. Port Depth (ft)	Cable ID No.	Nominal Length (ft)	Cable Type	Top Assembly			Bottom Assembly			Continuity Tests			Final Length (ft)	Final Accept
					# Strands	Adhesive	Connector	# Strands	Adhesive	Connector	A = Center	B = Armor	A to B		
		0-10	67.00												
10	47														
		10-8	100.00												
8	147														
		8-5	140.00												
5	287														
		5-3	65.00												
3	352														
		3-1	130.00												
1	482														
			(482.00)												
			-												
			-												
			-												

Signed:_____ Date:_____

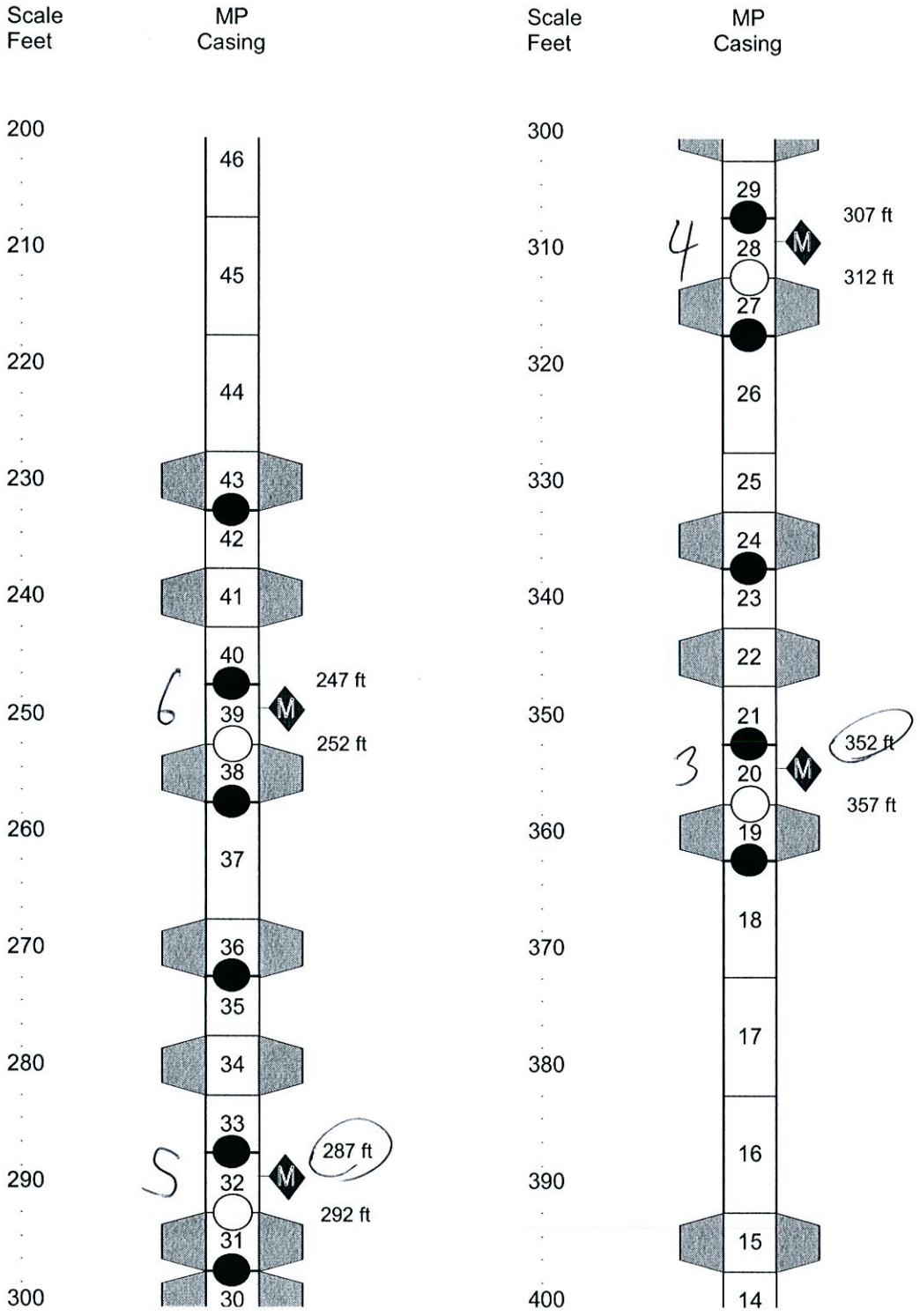
Summary Casing Log
CDM

Job No: WB845
Well: SVP--10



Summary Casing Log
CDM

Job No: WB845
Well: SVP--10



Summary Casing Log
CDM

Job No: WB845
Well: SVP--10

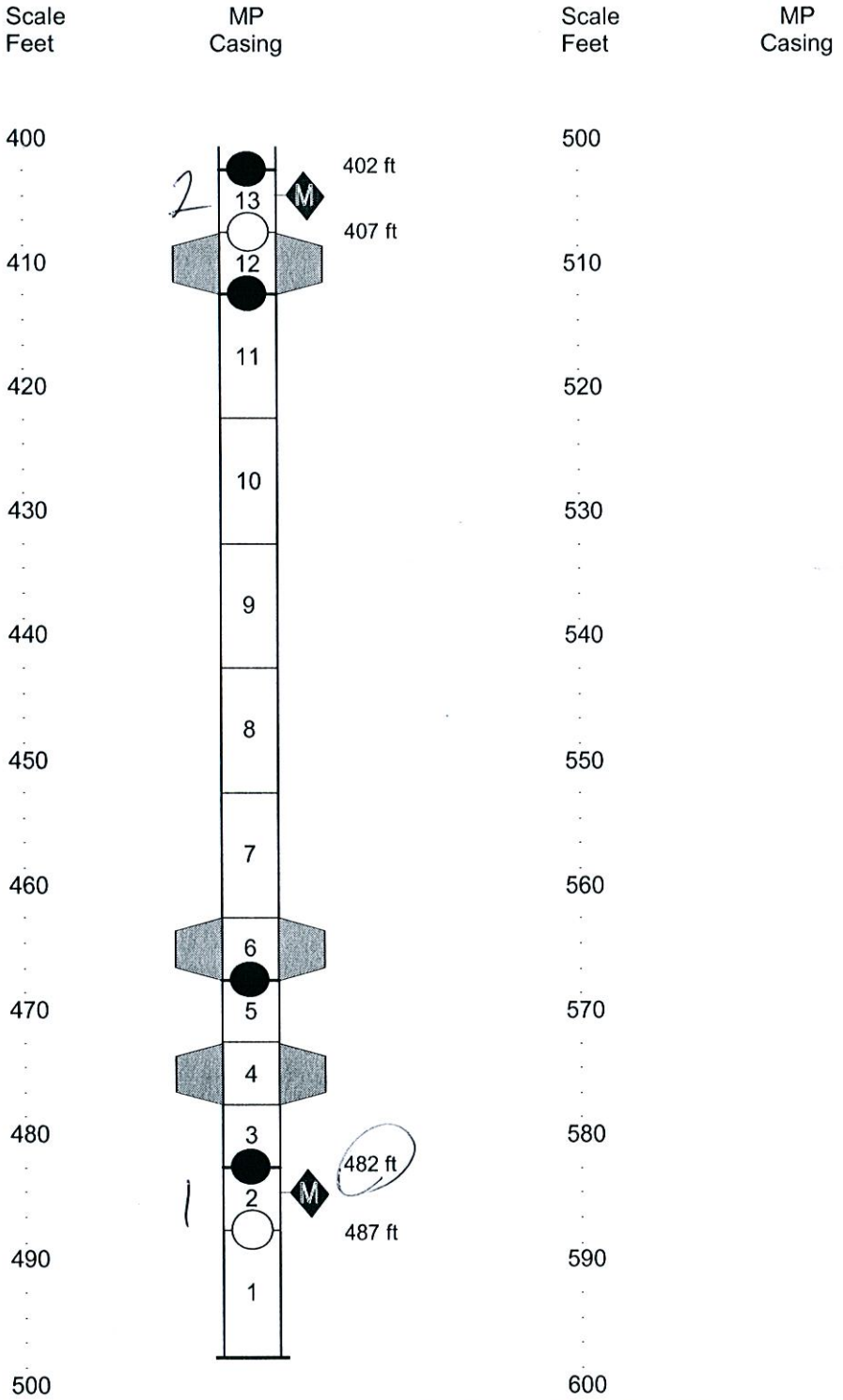


Table 3b, Depths of Key Items for Westbay monitoring well: SVP-10.

Zone No.	Screen Interval* (From video log)	Packer No.	Packer Serial No.	Nominal Packer Position ***	Magnetic Collar Depth	Measurement Port Depth**	Pumping Port Depth**	Port Name
Zone 1	480-485	1	16336	472	484	**482**	487	**Zone 1**
QA 1		2	16337	462		467		QA 1
QA 2		3	16235	407		412		QA 2
Zone 2	400-405	4	16224	392	404	**402**	407	**Zone 2**
QA 3		5	16233	357		362		QA 3
Zone 3	350-355	6	16232	342	354	**352**	357	**Zone 3**
QA 4		7	16231	332		337		QA 4
QA 5		8	16250	312		317		QA 5
Zone 4	305-310	9	16248	297	309	**307**	312	**Zone 4**
QA 6		10	16249	292		297		QA 6
Zone 5	285-290	11	16247	277	389	**287**	292	**Zone 5**
QA 7		12	16246	267		272		QA 7
QA 8		13	16255	252		257		QA 8
Zone 6	245-250	14	16254	237	249	**247**	252	**Zone 6**
QA 9		15	16253	227		232		QA 9
QA 10		16	16252	192		197		QA 10
Zone 7	185-190	17	16251	177	189	**187**	192	**Zone 7**
QA 11		18	16236	167		172		QA 11
QA 12		19	16237	152		157		QA 12
Zone 8	145-150	20	16238	137	149	**147**	152	**Zone 8**
QA 13		21	16245	127		132		QA 13
QA 14		22	16239	107		112		QA 14
Zone 9	100-15	23	16240	92	104	**102**	107	**Zone 9**
QA 15		24	16244	82		87		QA 15
QA 16		25	16243	52		57		QA 16
Zone 10	45-50	26	16242	37	49	**47**	52	**Zone 10**
QA 17		27	16241	27		32		QA 17

* Depths are with respect to ground level.

** Component positions are referenced to the top of the subject Westbay System coupling.

*** Packer positions are referenced to the top Westbay System coupling on the packer.

Appendix B

Pump and Flow Meter Information

THE RANGER™

The Ranger™ Series 4" high-flow submersible pumps are perfect for applications requiring a large volume of water. Stainless steel components and high-density composite resin impellers provide exceptional resistance to corrosion in harsh water conditions. The high-torque motor and superior pump hydraulics are carefully matched to handle virtually any job.

APPLICATIONS

Water systems... irrigation, industrial, commercial, multiple housing and farm clean water use

SPECIFICATIONS

- Shell – 304 Stainless Steel
- Discharge – 304 Stainless Steel
- Discharge Bearing – Buna-N
- Impellers – Noryl®
- Diffusers – Noryl
- Suction Caps – Noryl
- Shaft and Coupling – 304 Stainless Steel
- Intake – 304 Stainless Steel
- Intake Screen – 304 Stainless Steel
- Cable Guard – 304 Stainless Steel
- Check Valve – Polyester Teflon®
- Fasteners – 304 Stainless Steel

FEATURES

Turn Up the Volume
High-flow capacities to 100 GPM make the Ranger 4" sub the easy choice for the really big jobs

More Stainless Steel
Shell, discharge and suction bowl, shaft and coupling, lead guard and suction screen – all lead-free

Staged for Toughness
Specially designed, high-density thermoplastic impellers resist the corrosive wear from harsh water conditions

High-powered Performance
Features a high-torque, heavy-duty motor for the most demanding applications

C US

Drinking Water NSF/ANSI 61

Noryl® is a registered trademark of the General Electric Company. Nylatron® is a registered trademark of The Polymer Corporation. Teflon® is a registered trademark of Dupont. Ranger™ is a trademark of Pentair Water.

ORDERING INFORMATION – PUMP

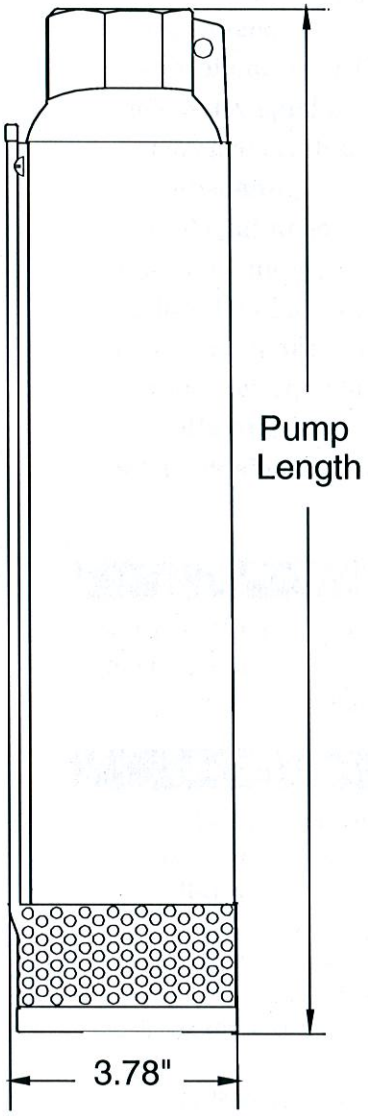
GPM	HP	Stages	Assembled Pump		
			Catalog Number	Length Inches*	Weight Pounds*
25	1	7	SS10-25	18	12
	1-1/2	9	SS15-25	21	14
	2	11	SS20-25	24	15
	3	15	SS30-25	30	19
	5	25	SS50-25	48	27
	7-1/2	37	SS75-25	67	55
35	1	4	SS10-35	15	10
	1-1/2	6	SS15-35	18	12
	2	8	SS20-35	22	14
	3	11	SS30-35	28	17
	5	18	SS50-35	43	24
	7-1/2	28	SS75-35	62	52
	10	37	SS100-35	75	63
50	1-1/2	6	SS15-50	21	14
	2	7	SS20-50	23	15
	3	10	SS30-50	31	19
	5	16	SS50-50	48	27
	7-1/2	25	SS75-50	70	59
	10	32	SS100-50	84	68
80	2	6	SS20-80	29	16
	3	9	SS30-80	39	20
	5	14	SS50-80	59	45
	7-1/2	22	SS75-80	66	59
	10	27	SS100-80	100	69

MOTOR / CONTROL BOX

HP	No. of Wires	Volts	PH	PENTEK® Motor			PENTEK Control Box Catalog Number
				Catalog Number	Length Inches*	Weight Pounds*	
1	2	230	1	P42B0010A2	12	22	
	3	230	1	P43B0010A2	12	22	SMC-CR1021
1-1/2	2	230	1	P42B0015A2	15	30	
	3	230	1	P43B0015A2	14	27	SMC-CR1521
		230	3	P43B0015A3	13	23	SMC-CR1521
2	3	230	1	P43B0020A2	15	29	SMC-CR2021
		230	3	P43B0020A3	14	27	SMC-CR2021
3	3	230	1	P43B0030A2	24	49	SMC-CR3021
		230	3	P43B0030A3	21	40	SMC-CR3021
5	3	230	1	P43B0050A2	30	66	SMC-CR5021
		230	3	P43B0050A3	24	50	SMC-CR5021
7-1/2	3	230	3	P43B0075A3	30	66	SMC-CR7521

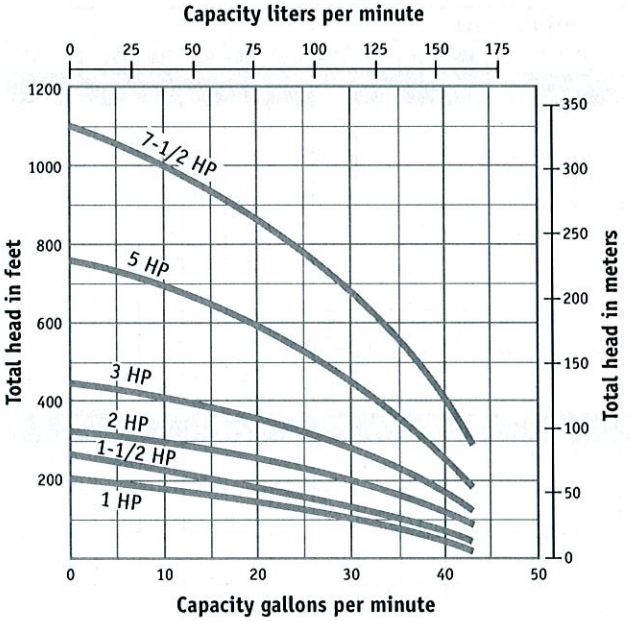
Length and weight are approximate.

OUTLINE DIMENSIONS

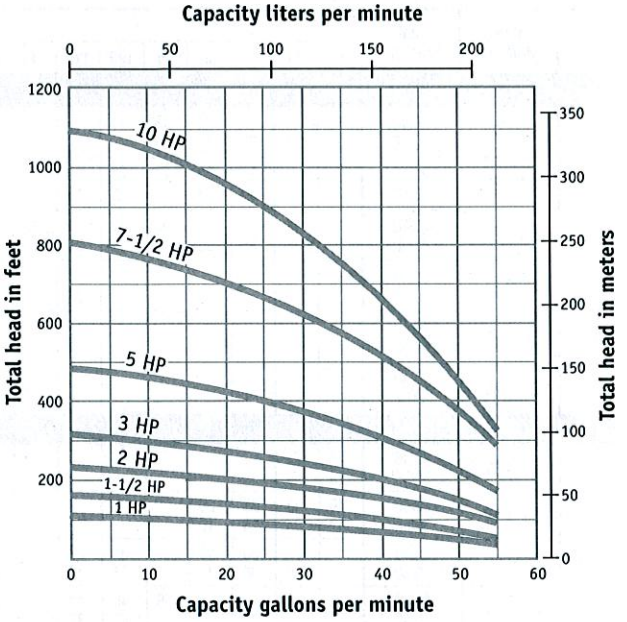


THE RANGER™ 4" SUBMERSIBLE PUMPS

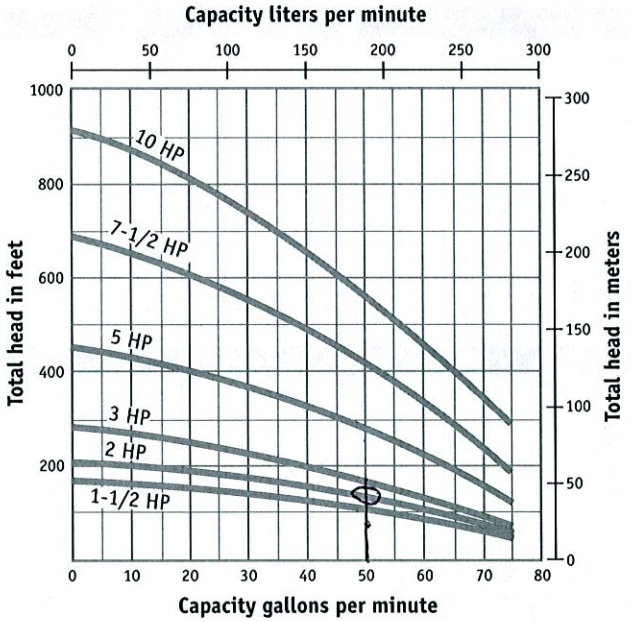
PUMP PERFORMANCE - 25 GPM



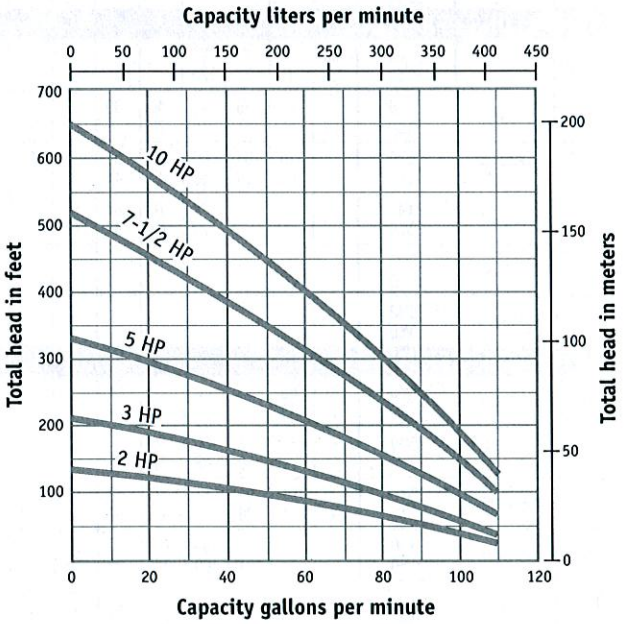
PUMP PERFORMANCE - 35 GPM



PUMP PERFORMANCE - 50 GPM



PUMP PERFORMANCE - 80 GPM



PUMP PERFORMANCE

HP	Catalog Number	Tank Pressure	Pumping Depth in Feet																						
			0	20	40	60	80	100	120	140	160	180	200	250	300	350	400	450	500	550	600	650	700	750	800	850
25 GALLONS PER MINUTE																										
1	SS10-25	20/40 30/50	35 30	31 28	27 22	22 17	18 12	11																		
1-1/2	SS15-25	20/40 30/50	36	33	33 30	30 27	27 23	23 20	20 15	15																
2	SS20-25	20/40 30/50			38	36	36 33	33 31	31 27	28 24	25 20	21 16	17													
3	SS30-25	20/40 30/50							36	34	32	33 30	30 28	25 22	18 15											
5	SS50-25	20/40 30/50											38	37 36	34 33	31 30	28 27	25 24	22 21	18 16	13					
7-1/2	SS75-25	20/40 30/50														39	37	36	34 34	32 32	30 29	28 27	26 24	23 22	19 18	16 15
35 GALLONS PER MINUTE																										
1	SS10-35	20/40 30/50	37 25	25																						
1-1/2	SS15-35	20/40 30/50	49 42	43 34	35 26	28 15																				
2	SS20-35	20/40 30/50		50	50 46	46 40	41 33	35 26	27 16																	
3	SS30-35	20/40 30/50				49	49 45	46 42	42 37	38 33	33 26	27 21	15													
5	SS50-35	20/40 30/50								49	49 47	47 45	45 43	39 36	32 28	23 18										
7-1/2	SS75-35	20/40 30/50													50 49	47 46	44 43	40 38	36 34	32 30	27 24	16				
10	SS100-35	20/40 30/50														51 49	49 48	48 47	46 45	43 42	40 39	38 37	35 34	32 30	29 27	25 23
50 GALLONS PER MINUTE																										
1-1/2	SS15-50	20/40 30/50	65 55	56 45	46 34	37 20																				
2	SS20-50	20/40 30/50	70 64	63 55	56 47	47 40	40 29	30																		
3	SS30-50	20/40 30/50	70	70 64	64 60	60 55	55 49	50 44	44 35	36 29																
5	SS50-50	20/40 30/50				72 70	70 66	67 64	64 60	61 57	57 54	54 50	51 46	41 36	30 23											
7-1/2	SS75-50	20/40 30/50									70 67	67 65	65 63	60 58	55 53	49 46	43 40	35 32								
10	SS100-50	20/40 30/50												68 67	65 63	61 59	58 56	53 51	48 46	44 42	39 37	33 30				
80 GALLONS PER MINUTE																										
2	SS20-80	20/40 30/50	75 58	56 40	40																					
3	SS30-80	20/40 30/50	93 81	81 71	72 60	60 48	50 37																			
5	SS50-80	20/40 30/50	100	101 94	94 88	87 80	80 72	72 62	63 58	57 50	49 40	40														
7-1/2	SS75-80	20/40 30/50			104	104 100	100 96	96 90	91 87	87 82	82 78	77 72	72 67	60 52	45 39											
10	SS100-80	20/40 30/50						104 101	97 95	95 93	93 90	89 86	84 81	72 70	68 65	58 55										

16273

Serial Number	NA		Reading	128	
Flow Rate	Low 7.0	Inter 120.0	Full 275.0		
Test Registration	✓	✓	✓		
Factor	✓	→		LAWCO	
Final % Registration	99.0	99.0	99.0		
Reg. Gear Electronic	SB Gear Electronic	Size 3"	Cu. Ft. ☐ Gal. ☐ ✓		
Style SeaMetrics	Tester KLB	Date 2/2010			

16205

Serial Number	NA		Reading	33411.5	
Flow Rate	Low 4.0	Inter 60.0	Full 110.0		
Test Registration	✓	✓	✓		
Factor	✓	→		LAWCO	
Final % Registration	98.0	101.0	99.8		
Reg. Gear Electronic	SB Gear Electronic	Size 2"	Cu. Ft. ☐ Gal. ☐ ✓		
Style SeaMetric	Tester KLB	Date 2/2010			

16204

Serial Number	NA		Reading	10.4	
Flow Rate	Low 4.0	Inter 60.0	Full 110.0		
Test Registration	✓	✓	✓		
Factor	✓	→		LAWCO	
Final % Registration	104.0	104.0	104.0		
Reg. Gear Electronic	SB Gear Electronic	Size 2"	Cu. Ft. ☐ Gal. ☐ ✓		
Style SeaMetric	Tester KLB	Date 2/2010			

Appendix C

Step Test Water Level and Flow Rate Data

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** F. Robinson / J. Dohnalek

WELL: EW-7S STEP 1 Flow Rate: 40 GPM

TIME	E.T. (Elapsed time)	DTW	D. DOWN	FLOW RATE	TOTALIZER
—	STATIC	33.93	—	—	~~3659.1~~
0800:30	0.5	35.22			
0801	1	35.92			
0802	2	35.80		39.8	~~39.8 FR~~
0803	3	35.91		40	~~40 FR~~
0804	4	35.91		39.8	~~39.8 FR~~
0805	5	35.92			
0806	6	35.99		40.2	
0807	7	35.98		40.3	
0808	8	35.98		40.3	
0809	9	35.97		40.5	
0810	10	36.03		40.3	
0811	11	36.03		40.0	
0812	12	36.03		40.0	
0813	13	36.03		39.8	
0814	14	36.02		39.7	
0815	15	36.00		39.6	
0820	20	36.03		39.7	44 68.5
0825	25	36.02		39.9	
0830	30	36.03		39.4	483 40.5
0835	35	36.03		39.7	
0840	40	36.02		39.7	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** FR/JD

WELL: EW-15 Step 1: Flow Rate 40 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0845	45	36.06		39.9	5434.9
0850	50	36.07		39.8	
0900	60	36.08		39.8	6023.2
0910	70	36.09		39.6	
0920	80	36.13		39.8	6807.5
0930	90	36.13		40.0	
0940	100	36.13		39.7	7549.3
0950	110	36.15		39.8	
1000	120	36.18		39.6	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** FR/JD

WELL: EW-15 Step 2 Flow Rate = 60

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1000:30	0.5	37.08		60.0	
1001	1	37.20		60.0	8456.6
1002	2	37.15		60.0	
1003	3	37.17		60.0	
1004	4	37.17		60.0	
1005	5	37.22		60.0	
1006	6	37.22		60.0	
1007	7	37.23		60.0	
1008	8	37.26		60.0	
1009	9	37.22		60.0	
1010	10	37.24		60.0	
1011	11	37.20		60.0	
1012	12	37.23		60.0	
1013	13	37.26		60.0	
1014	14	37.22		60.0	
1015	15	37.23		60.0	
1020	20	37.22		60.0	
1025	25	37.13		60.0	
1030	30	37.05		60.0	10164.4
1035	35	36.96		60.0	
1040	40	36.91		60.0	

ORF WATER LEVEL DATA

Step **TESTING**

DATE: ~~10~~ 8/31/10 **NAME:** FR + JD

WELL: EW-15 Step 2 Flow Rate = 60

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1045	45	36.85		60.0	
1050	50	36.83		60.0	
1100	60	36.70		60.0	
1110	70	~~36.61~~ 36.61		60.0	
1120	80	~~36.61~~ 36.61		60.0	
1130	90	36.61		60.0	
1140	100	36.59		60.0	
1150	110	36.55		60.0	
1200	120	36.56		60.0	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** FR + JD

WELL: EW-15 Step 3 Flow Rate - 75 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1200:30	0.5	37.04		75	
1201	1	37.21		75	
1202	2	37.20		75	
1202	3	37.20		75	
1204	4	37.23		75	
1205	5	37.20		75	16042.7
1206	6	37.21		75	
1207	7	37.21		75	
1208	8	37.22		75	
1209	9	37.25		75	
1210	10	37.23		75	
1211	11	37.23		75	
1212	12	37.25		75	
1213	13	37.22		75	
1214	14	37.22		75	
1215	15	37.23		75	
1220	20	37.22		75	
1225	25	37.18		75	
1230	30	37.22		75	17912.4
1235	35	37.21		75	
1240	40	37.22		76	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** FR + JD

WELL: EW-15 Flow Rate = 75 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1245	45	37.22		76.0	
1250	50	37.22		76.0	
1255	55	37.18		75.0	
1300 ~~1300~~	60	37.20		75.0	20165.1
1310	70	37.18		75.0	
1320	80	37.19		75.0	
1330	90	37.18		75.0	22510.3
1340	100	37.21		75.0	
1350	110	37.18		75.0	
1400	120	37.18		75.0	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** AR + JD

WELL: ES-15 Step 4: 90 GPM

TIME ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1400:30 0.5	37.75		90 GPM	24713.6
1401 1	37.78		90 GPM	
1402 2	37.82		90 GPM	
1403 3	37.84		90.0 GPM	
1404 4	37.85		90 GPM	
1405 5	37.85		90 GPM	
1406 6	37.84		90 GPM	
1407 7	37.86		90 GPM	
1408 8	37.86		90 GPM	
1409 9	37.85		90 GPM	
1410 10	37.86		90 GPM	
1411 11	37.87		90 GPM	
1412 12	37.87		90 GPM	
1413 13	37.87		90 GPM	
1414 14	37.84		90 GPM	
1415 15	37.82		90 GPM	
1420 20	37.87		90 GPM	
1425 25	37.85		90 GPM	
1430 30	37.86		90 GPM	
1435 35	37.86		90 GPM	
1440 40	37.86		90 GPM	
~~1445 45~~	~~37.86 JR~~		~~90~~ JR	

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** KR + JN

WELL: EW-25 Step 4: 90 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1445	45	37.86		90	
1450	50	37.86		90	
1455	55	37.86		90 GPM	
1500	60	37.84		90	30052.2
1510	70	37.87		90	
1520	80	37.87		90	
1530	90	37.86		90 GPM	32776.3
1540	100	37.86		90	
1550	110	37.85		90	
1600	120	37.85		90 GPM	

Water Quality

time	T°C	Cond	DO	pH	ORP	NTU
1545	17.31	0.644	3.07	4.58	184.7	1.2
1550	17.31	0.642	3.07	4.57	188.3	1.1
1555	17.30	0.642	2.16	4.59	188.4	1.2
1600	17.33	0.641	2.18	4.61	189.2	1.1

Final flow meter reading	36385.7	EW-15
Initial flow " "	3659.1	EW-15
Total	32,726.6	
Final flow meter reading	17726859	Combined
Initial flow meter reading	17692363	Combined
	034496	

DO = mg/l Cond = mS/cm

33.93

ORF WATER LEVEL DATA

Step TESTING

DATE: 8/31/10 **NAME:** FR/JD

WELL: EW-1 ~~S~~ Recovery Pump off @ 1610

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1610:30	0.5	34.08			
1611	1	33.83			
1612	2	33.67			
1613	3	33.62			
1614	4	~~33.52~~ 33.59			
1615	5	33.55			
1616	6	33.55			
1617	7	33.54			
1618	8	33.55			
1619	9	33.57			
1620	10	33.57			
1621	11	33.53			
1622	12	33.53			
1623	13	33.57			
1624	14	33.60			
1625	15	33.60			
1630	20	33.67			
1635	25	33.70			
1640	30	33.80			
1645	35	33.85			
1650	40	33.88			

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** AR+JD

WELL: EW-1D Step 1: 40 GPM
Static = 35.00 totalizer start = 535.4 Gallons

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0800:30	0.5	36.30		40.7	
0801	1	36.80			
0802	2	36.05		40.3	
0803	3	36.08		40.2	
0804	4	36.07		40.4	
0805	5	36.10		40.5	
0806	6	36.11		40.6	
0807	7	36.09		40.5	
0808	8	36.12		40.1	
0809	9	36.09		40.4	
0810	10	36.12		40.5	
0811	11	36.14			
	12	missed reading, NOTES BY DOUGHERTY			
0813	13	36.17		40.4	
0814	14	36.15		40.4	
0816	15	36.17		40.3	
0820	20	36.17		40.7	Relinquish to GW.
0825	25	36.16		40.2	Frank Robinson
0830	30	36.17		40.6	
0835	35	36.17		40.5	
0840	40	36.19		40.3	
0845	45	36.20		40.2	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** AR + JD

WELL: EW-11 Step 1 = 406pm

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0850	50	36.20		40.5	
0855	55	36.20		40.7	
0900	60	36.19		40.3	
0910	70	36.24		40.4	
0920	80	36.25		40.3	
0930	90	36.27		40.3	
0940	100	36.31		40.3	4587.2
0950	110	36.30		40.3	
1000	120	36.33		40.3	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** AR + JD

WELL: EW-1I Step 2 = 60 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1000:30	0.5	36.55			
1001	1	36.80		61 GPM	
1002	2	36.83		62 GPM	
1003	3	36.83		60 GPM	
1004	4	36.82		60 GPM	
1005	5	36.82		60 GPM	
1006	6	36.82		60 GPM	
1007	7	36.81		60 GPM	
1008	8	36.81		60 GPM	
1009	9	36.82		60 GPM	
1010	10	36.83		60 GPM	
1011	11	36.82		60 GPM	
1012	12	36.82		60 GPM	
1013	13	36.83		60 GPM	
1014	14	36.81		60 GPM	
1015	15	36.81		60 GPM	
1020	20 ~~FT~~	36.83		60 GPM	
1025	25 ~~FT~~	36.82		60 GPM	
1030	30 ~~FT~~	36.81		60 GPM	
1035	35 ~~FT~~	36.84		60 GPM	
1040	40	36.82		60 GPM	
1045	45	36.83		60 GPM	

ORF WATER LEVEL DATA

Step **TESTING**

DATE: 9/1/10 **NAME:** FR + JD

WELL: EW-II Step 2 = 60 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1050	50	36.81		60 GPM	
1055	55	36.82		60 GPM	
1100	60	36.83		60 GPM	
1110	70	36.86		60 GPM	
1120	80	36.87		60 GPM	
1130	90	36.87		60 GPM	
1140	100	36.86		60 GPM	
1150	110	36.88		60 GPM	
1200	120	36.88		60 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** FR+ JD

WELL: EW-1I Step 3 = 75 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1200:30	0.5	37.20			
1201	1	37.25		75 GPM	
1202	2	37.27		75 GPM	
1203	3	37.27		75 GPM	
1204	4	37.28		75 GPM	
1205	5	37.28		75 GPM	
1206	6	37.28		75 GPM	
1207	7	37.28		75 GPM	
1208	8	37.29		75 GPM	
1209	9	37.30		75 GPM	
1210	10	37.31		75 GPM	
1211	11	37.30		75 GPM	
1212	12	37.31		75 GPM	
1213	13	37.31		75 GPM	
1214	14	37.28		75 GPM	
1215	15	37.28		75 GPM	
1220	20	37.31		75 GPM	
1225	25	37.31		75 GPM	
1230	30	37.30		75 GPM	
1235	35	37.30		75 GPM	
1240	40	37.31		75 GPM	
1245	45	37.31		75 GPM	

ORF WATER LEVEL DATA

Step **TESTING**

DATE: 9/1/10 **NAME:** FR + JP

WELL: EW-1 I Step 3= 75 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1250	50	37.32		75 GPM	
1255	55	37.32		75 GPM	
1300	60	37.33		75 GPM	17039.6
1310	70	37.32		75 GPM	
1320	80	37.33		75 GPM	
1330	90	37.32		75 GPM	
1340	100	37.32		75 GPM	
1350	110	37.34		75 GPM	
1350	120	37.35		75 GPM	

ORF WATER LEVEL DATA

Step **TESTING**

DATE: 9/1/10 **NAME:** AR + JD

WELL: EW-1I Step 4= 90 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1400:30	0.5	37.73			
1401	1	37.73		90 GPM	
1402	2	37.74		90 GPM	
1403	3	37.74		90 GPM	
1404	4	37.75		90 GPM	
1405	5	37.75		90 GPM	
1406	6	37.74		90 GPM	
1407	7	37.76		90 GPM	
1408	8	37.76		90 GPM	
1409	9	37.76		90 GPM	
1410	10	37.76		90 GPM	
1411	11	37.74		90 GPM	
1412	12	37.75		90 GPM	
1413	13	37.76		90 GPM	
1414	14	37.75		90 GPM	
1415	15	37.75		90 GPM	
1420	20	37.75		90 GPM	
1425	25	37.76		90 GPM	
1430	30	37.76		90 GPM	
1435	35	37.76		90 GPM	
1440	40	37.75		90 GPM	
1445	45	37.75			

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** ER + JD

WELL: EW-II Step 4 = 90 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1450	50	37.76		90 GPM	
1455	55	37.76		90 GPM	
1500	60	37.75		90 GPM	
1510	70	37.76		90 GPM	
1520	80	37.75		90 GPM	
1530	90	37.75		90 GPM	
1540	100	37.74		90 GPM	
1550	110	37.75		90 GPM	
1600	120	37.75		90 GPM	
				Totalizer End = 32893.7	
off @ 1608					

Water Quality

Time	T°C	Cond	DO	pH	ORP	NTU
1545	15.98	0.394	5.42	4.58	238.7	1.24
1550	15.95	0.394	4.33	4.53	250.3	0.51
1555	15.95	0.393	4.23	4.55	252.5	0.53
1600	15.98	0.392	4.09	4.56	254.6	0.71

DO = mg/l
Cond = mS/cm

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/1/10 **NAME:** FR + JD

WELL: EW-1I Recovery off @ 1608

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1608:30	0.5	35.72			
1609	1	35.65			
1610	2	35.60			
1611	3	35.58			
1612	4	35.58			
1613	5	35.55			
1614	6	35.56			
1615	7	35.56			
1616	8	35.56			
1617	9	35.55			
1618	10	35.54			
1619	11	35.54			
1620	12	35.54			
1621	13	35.54			
1622	14	35.53			
1623	15	35.53			
1628	20	35.54			
1633	25	35.51			
1638	30	35.51			
1643	35	35.50			
	40				
	45				

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + JD

WELL: EW-1D Step 1: 60 GPM

Static = 35.70 totalizer = 978502.2

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0600:30	0.5	37.00			
0601	1	37.25			
0602	2	37.40			
0603	3	37.58		60 GPM	
0604	4	37.62		61 GPM	
0605	5	37.61		61 GPM	
0606	6	37.61		61 GPM	
0607	7	37.65		61 GPM	
0608	8	37.65		61 GPM	
0609	9	37.65		61 GPM	
0610	10	37.66		61 GPM	
0611	11	37.66		61 GPM	
0612	12	37.66		61 61 GPM	
0613	13	37.67		61 GPM	
0614	14	37.66		61 GPM	
0615	15	37.66		61 GPM	
0620	20	37.68		61 GPM	
0625	25	37.72		61 GPM	
0630	30	37.73		61 GPM	
0635	35	37.73		61 GPM	
0640	40	37.75		61 GPM	
0645	45	37.79		61 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + SD

WELL: EW-1D Step 1: 60 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0650	50	37.81		61 GPM	
0655	55	37.82		61 GPM	
0700	60	37.82		61 GPM	
0710	70	37.83		61 GPM	
0720	80	37.87		61 GPM	
0730	90	37.89		61 GPM	984084.7
0740	100	37.93		61 GPM	
0750	110	37.94		61 GPM	
0800	120	37.94		61 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + JD

WELL: EW-1D Step 2: 100 Gpm

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0800:36	0.5	39.25			
0801	1	38.95			
0802	2	39.25		101 GPM	
0803	3	39.34		99 GPM	
0804	4	39.15		99 GPM	
0805	5	39.16		100 GPM	
0806	6	39.21		100 GPM	
0807	7	39.22		100 GPM	
0808	8	39.22		100 GPM	
0809	9	39.21		100 GPM	
0810	10	39.22		100 GPM	
0811	11	39.23		100 GPM	
0812	12	39.23		100 GPM	
0813	13	39.23		100 GPM	
0814	14	39.24		100 GPM	
0815	15	39.24		100 GPM	
0820	~~15~~ 20	39.25		100 GPM	
0825	~~0830~~ ~~20~~ 25	39.25		100 GPM	
0830	~~25~~ 30	39.26		100 GPM	
0835	35	39.26		100 GPM	
0840	40	39.28		100 GPM	
0845	45	39.28		100 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + JD

WELL: EW-1D Step 2: 100 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
0850	50	39.28		100 GPM	
0855	55	39.29		100 GPM	
0900	60	39.31		100 GPM	
0910	70	39.32		100 GPM	
0920	80	39.33		100 GPM	
0930	90	39.35		100 GPM	
0940	100	39.38		100 GPM	
0950	110	39.38		100 GPM	
1000	120	39.39		100 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + JD

Step 3: 140 GPM

WELL: EW-2D

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1000:30	0.5	40.52			
1001	1	40.58		140 GPM	
1002	2	40.62		140 GPM	
1003	3	40.63		140 GPM	
1004	4	40.63		140 GPM	
1005	5	40.64		140 GPM	
1006	6	40.65		140 GPM	
1007	7	40.67		140 GPM	
1008	8	40.68		140 GPM	
1009	9	40.68		140 GPM	
1010	10	40.68		140 GPM	
1011	11	40.69		140 GPM	
1012	12	40.70		140 GPM	
1013	13	40.71		140 GPM	
1014	14	40.72		140 GPM	
1015	15	40.71		140 GPM	
1020	20	40.71		140 GPM	
1025	25	40.73		140 GPM	
1030	30	40.71		140 GPM	
1035	35	40.71		140 GPM	
1040	40	40.72		140 GPM	
1045	45	40.72		140 GPM	

ORF WATER LEVEL DATA

Step **TESTING**

DATE: 9/2/10 **NAME:** ER, JD

WELL: EW-1D Step 3: 140 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1050	50	40.73		140 GPM	
1055	55	40.75		140 GPM	
1100	60	40.75		140 GPM	
1110	70	40.76		140 GPM	
1120	80	40.79		140 GPM	
1130	90	40.82		140 GPM	
1140	100	40.82		140 GPM	
1150	110	40.82		140 GPM	
1200	120	40.83		140 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/2/10 **NAME:** FR + JD

WELL: EW-1D Step 4: 180 GPM

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1200:30	0.5	42.00			
1201	1	42.11		180 GPM	
1202	2	42.13		180 GPM	
1203	3	42.12		180 GPM	
1204	4	42.12		180 GPM	
1205	5	42.12		180 GPM	
1206	6	42.13		180 GPM	
1207	7	42.12		180 GPM	
1208	8	42.12		180 GPM	
1209	9	42.13		180 GPM	
1210	10	42.13		180 GPM	
1211	11	42.13		180 GPM	
1212	12	42.15		180 GPM	
1213	13	42.14		180 GPM	
1214	14	42.13		180 GPM	
1215	15	42.13		180 GPM	
1220	20	42.13		180 GPM	
1225	25	42.13		180 GPM	
1230	30	42.15		180 GPM	
1235	35	42.19		180 GPM	
1240	40	42.20		180 GPM	
1245	45	42.18		180 GPM	

ORF WATER LEVEL DATA

Step TESTING

DATE: 9/21/10 **NAME:** ER + JD

WELL: EW-1D

Step Test 4 → Final Totalizer = 180 GPM → 1037912.4

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1250	50	42.19		180 GPM	
1255	55	42.19		180 GPM	
1300	60	42.20		180 GPM	
1310	70	42.21		180 GPM	
1320	80	42.21		180 GPM	
1330	90	42.21		180 GPM	
1340	100	42.22		180 GPM	
1350	110	42.21		180 GPM	
1400	120	42.21		180 GPM	

Water Quality

Time	T°C	Cond.	DO	pH	ORP	aTU
1345	14.61	0.322	4.66	4.62	277.8	1.21
1350	14.57	0.322	4.13	4.60	283.7	1.23
1355	14.55	0.322	3.85	4.60	288.4	1.03
1400	14.58	0.322	3.76	4.60	291.0	1.04

DO = mg/l

Cond = mS/cm

ORF WATER LEVEL DATA

Step TESTING

off @ 1412

DATE: 9/2/10 **NAME:** FR+JD

WELL: EW-1D Recovery

TIME	ET	DTW	D. DOWN	FLOW RATE	TOTALIZER
1412:30	0.5	37.20			
1413	1	37.00			
1414	2	36.83			
1415	3	36.70			
1416	4	36.67			
1417	5	36.65			
1418	6	36.58			
1419	7	36.60			
1420	8	36.57			
1421	9	36.55			
1422	10	36.57			
1423	11	36.55			
1424	12	36.52			
1425	13	36.50			
1426	14	36.48			
1427	15	36.50			
1433	20	36.44			
1438	25	36.43			
1443	30	36.41			
1448	35	36.38			
1453	40	36.38			
1458	45	36.38			

Appendix D

Sustained Yield Test Water Level and Flow Rate Data

Pumping Test Field Data Sheet

Well No. EW-15

totalizer start = 36869.5

Start 1030

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: Drawdown Recovery

Elevation MP:

Remarks:

Page: 1 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	0951	Static	34.67			~~78~~ 80	
		0.5					
		1					
	1032	2	37.90			~~72~~	
		3					
		4					
	1035	5	38.18			70	
		6					
		7					
		8					
		9					
	1040	10	38.28			70	
		11					
		12					
		13					
		14					
	1045	15	38.33			70	
	1050	20	38.39			70	
	1055	25	38.~~40~~			70	
	1100	30	38.45			70	
	1105	35	38.46			70	
	1110	40	38.51			70	
	1115	45	38.50			70	
	1120	50	38.51			70	
1HR	1130	60	38.53			70	
	1140	70	38.54			70	
	1150	80	38.54			70	
	1200	90	38.56			70	

Pumping Test Field Data Sheet

Well No. EW-1S

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: Drawdown Recovery

Elevation MP:

Remarks:

Page: 2 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	1210	100	38.52			70	
	1220	110	38.53			70	
2 HRS.	1230	120	38.55			70	
	1300	150	38.55			70	
3 HRS.	1330	180	38.55			70	
	1400	210	38.54			70	
4 HRS	1430	240	38.52			70	
	1500	270	38.51			70	
5 HR	1530	300	38.51			70	
	1600	330	38.49			70	
6 HRS.	1630	360	38.49			70	
	1700	390	38.49			70	
7 HRS.	1730	420	38.49			70	
	1800	450	38.22			70	
8 HRS.	1830	480	37.90			70	
	1900	510	37.74			70	
9 HRS.	1930	540	37.61			70	
	2000	570	37.58			70	
10 HRS.	2030	600	37.55			70	
11 HRS.	2130	660	37.50			70	
12 HRS.	2230	720	37.45			70	
	2330	780	37.8			70	
9/8/10	030	840	37.89			70	
	130	900	37.53			70	
	230	960	37.34			70	
	330	1020	37.28			70	
18 HRS.	430	1080	37.78			70	
	530	1140	38.18			70	

Pumping Test Field Data Sheet

Well No. EW-15

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 3 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
20 HRS. 9/8/10	1630	1200	38.31			70	
	0830	1260	38.35			70	
22 HRS.	0830	1320	38.51			70	
	0930	1380	38.60			70	
24 HRS.	1030	1440	38.62			70	
	1130	1500	38.64			70	
(1 DAY 2 HR) 26 HRS.	1230	1560	38.64			70	
	1330	1620	38.25			70	
(1 DAY 4 HR) 28 HRS.	1430	1680	38.50			70	
	1530	1740	38.52			70	
	1630	1800	38.00			70	
	1730	1860	37.71			70	
	1830	1920	37.61			70	
	1930	1980	37.50			70	
	2030	2040	37.52			70	
	2130	2100	38.50			70	
	2230	2160	37.87			70	
	2330	2220	37.51			70	
9/9/10	0030	2280	37.42			70	
	0130	2340	37.41			70	
	0230	2400	37.30			70	
	0330	2460	37.53			70	
	0430	2520	38.02			70	
	0530	2580	38.10			70	
	0630	2640	38.26			70	
	0730	2700	38.49			7	
	0830	2760	38.59			70	AM
	0930	2820	38.59			70	

Pumping Test Field Data Sheet

Well No. EW-1S

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 4 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/9/10	1030	2880	38.69			70	
	11:30	2940	38.79			70	
	12:30	3000	38.73			70	
	13 30	3060	38.72			70	
	14 30	3120	38.69			70	
	15 30	3180	38.64			70	
	16 30	3240	38.60			70	
	1730	3300	38.58			70	
	18.30	3360	37.92			70	
	1930	3420	37.67			70	
	2030	3480	37.58			70	
	2130	3540	37.47			70	
	22.30	3600	37.40			70	
	2330	3660	37.70			70	
9/10/10	030	3720	38.10			70	
	130	3780	37.57			70	
	230	3840	37.36			70	
	330	3900	37.32			70	
	0430	3960	37.80			70	
	0530	4020	38.10			70	
	0630	4080	38.31			70	
	0730	4140	38.41			70	
	0830	4200	38.52			70	
	0930	4260	38.66			70	
	1030	4320	38.65			70	

Pumping Test Field Data Sheet

Well No. EW-1S

Site: Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown ~~Recovery~~

Elevation MP: _____ off @ 1030

Remarks: _____

Page: 1 of ____

Date	Time (ET)	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	~~38.65~~	Static	38.65				
	1030:30	0.5	35.62				
	1031	1	35.44				
	1032	2	35.35				
	1033	3	35.32				
	1034	4	35.26				
	1035	5	35.16				
	1036	6	35.17				
	1037	7	35.17				
	1038	8	35.14				
	1039	9	35.12				
	1040	10	35.12				
	1041	11	35.11				
	1042	12	35.09				
	1043	13	35.06				
	1044	14	35.05				
	1045	15	35.04				
	1050	20	34.96				
	1055	25	34.92				
	1100	30	34.95				
	1105	35	34.90				
	1110	40	34.90				
	1115	45	34.88				
	1120	50	34.88				
	1130	60	34.90				
	1140	70	34.90				
	1150	80	34.88				
	1200	90	34.86				

Pumping Test Field Data Sheet

Well No. EW-15

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: Drawdown (Recovery)

Elevation MP:

Remarks:

Page: 2 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	1210	100	34.85				FRobinson
	1220	110	34.87				
	1230	120	34.78				
	1300	150	~~34.56~~ 34.75				
	1330	180	33.88				
	1400	210	34.35				
1433	~~1430~~	240	34.58				
	1500	270	34.62				
	1530	300	34.68				
		330	END OF OBSERVATIONS				
		360					
		390					
		420					
		450					
		480					
		510					
		540					
		570					
		600					
		660					
		720					
		780					
		840					
		900					
		960					
		1020					
		1080					
		1140					

9/10/10

Pumping Test Field Data Sheet

Well No. EW-15

Site Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 3 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
		1200					
		1260					
		1320					
		1380					
		1440					
		1500					
		1560					
		1620					
		1680					
		1740					
		1800					
		1860					
		1920					
		1980					
		2040					
		2100					
		2160					
		2220					
		2280					
		2340					
		2400					
		2460					
		2520					
		2580					
		2640					
		2700					
		2760					
		2820					

Pumping Test Field Data Sheet

Well No. EW-1S

Site Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 4 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
		2880					
		2940					
		3000					
		3060					
		3120					
		3180					
		3240					
		3300					
		3360					
		3420					
		3480					
		3540					
		3600					
		3660					
		3720					
		3780					
		3840					
		3900					
		3960					
		4020					
		4080					
		4140					
		4200					
		4260					
		4320					

Pumping Test Field Data Sheet

Well No. EW-1I

Site: Old Roosevelt Field

Totalizer start = 332 36.9
start 1030

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: (Drawdown) Recovery

Elevation MP: _____

Remarks: _____

Page: 1 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	0947	Static	35.55				
		0.5					
		1					
	1032	2	37.58			70	
		3					
		4					
		5				70	
	1035	6	37.75			70	
		7					
		8					
		9					
	1040	10	37.71			70	
		11					
		12					
		13					
		14					
	1045	15	37.81			70	
	1050	20	37.83			70	
	1055	25	37.86			70	
	1100	30	37.89			70	
	1105	35	37.91			70	
	1110	40	37.91			70	
	1115	45	37.93			70	
	1120	50	37.95			70	
	1130	60	37.97			70	
	1140	70	38.00			70	
	1150	80	38.00			70	
	1200	90	38.00			70	

Pumping Test Field Data Sheet

Well No. EW-1 I

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 2 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	1210	100	38.02			70	
	1220	110	38.00			70	
	1230	120	38.00			70	
	1300	150	38.01			70	
	1330	180	38.00			70	
	1400	210	37.99			70	
	1430	240	37.98			70	
	1500	270	37.97			70	
	1530	300	37.87			70	
	1600	330	37.90			70	
	1630	360	37.91			70	
	1700	390	37.91			70	
	1730	420	37.90			70	
	1800	450	37.17			70	
	1830	480	36.65			70	
	1900	510	36.55			70	
	1930	540	36.47			70	
	2000	570	36.48			70	
	2030	600	36.48			70	
	2130	660	36.30			70	
	2230	720	36.21			70	
	2330	780	36.3			70	
9/8/10 A.H. 9/9/10	0030	840	36.81			70	
	130	900	36.27			70	
	230	960	36.11			70	
	330	1020	36			70	
	430	1080	37.12			70	
	530	1140	3445			70	

Pumping Test Field Data Sheet

Well No. EW-1I

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 3 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/8/10	630	1200	37.67			70	
	0730	1260	37.80			70	
	0830	1320	37.95			70	
	0930	1380	38.02			70	
	1030	1440	38.04			70	24 HRS
	1130	1500	38.05			70	
	1230	1560	38.06			70	
	1330	1620	37.61			70	
	1430	1680	37.95			70	
	1530	1740	37.94			70	
	1630	1800	36.95			70	
	1730	1860	36.58			70	
	1830	1920	36.43			70	
	1930	1980	36.30			70	
	2030	2040	36.68			70	
	2130	2100	37.42			70	
	2230	2160	36.67			70	
	2330	2220	36.22			70	
9/9/10	030	2280	36.20			70	
	130	2340	36.10			70	
	0230	2400	36.05			70	
	0330	2460	36.81			70	
	430	2520	37.36			70	
	530	2580	37.48			70	
	630	2640	37.71			70	
	0730	2700	37.85			70	
	0830	2760	37.94			69	END.
	0930	2820	38.05			70	

Pumping Test Field Data Sheet

Well No. FW-1I

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 4 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/9/10	1030	2880	38.11			70	
	1130	2940	38.15			70	
	1230	3000	38.17			70	
	1330	3060	38.18			70	
	1430	3120	38.17			70	
	1530	3180	38.10			70	
	1630	3240	38.05			70	
	1730	3300	37.91			70	
	1830	3360	36.80			70	
	1930	3420	36.46			70	
	2030	3480	36.86			70	
	2130	3540	36.20			70	
	2230	3600	36.14			70	
	2330	3660	36.93			70	
9/10/10	0030	3720	37.36				
	0130	3780	36.25			70	
	0230	3840	36.12			70	
	0330	3900	35.98			70	
	0430	3960	37.11			70	
	0530	4020	37.42			70	
	0630	4080	37.63			70	
	0730	4140	37.78			70	
	0830	4200	37.91			70	
	0930	4260	38.11			70	
	1030	4320	38.15			70	

Pumping Test Field Data Sheet

Well No. EW-1I

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Elevation MP:

Remarks:

Phase of Test: Drawdown (Recovery)

off @ 1030

Page: 1 of

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	—	Static	38.15				
	1030	0.5	36.37				
	1031	1	36.30				
	1032	2	36.20				
	1033	3	36.16				
	1034	4	36.11				
	1035	5	36.07				
	1036	6	36.04				
	1037	7	36.02				
	1038	8	36.02				
	1039	9	36.01				
	1040	10	36.00				
	1041	11	36.00				
	1042	12	35.95				
	1043	13	35.95				
	1044	14	35.95				
	1045	15	35.93				
	1050	20	35.90				
	1055	25	35.80				
	1100	30	35.82				
	1105	35	35.81				
	1110	40	35.80				
	1115	45	35.79				
	1120	50	35.77				
	1130	60	35.77				
	1140	70	35.75				
	1150	80	35.73				
	1200	90	35.70				

Pumping Test Field Data Sheet

Well No. EW-1I

Site Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 2 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	1210	100	35.68				
	1220	110	35.69				
	1230	120	35.68				
	1300	150	35.15				
	1330	180	34.18				
	1400	210	35.18				
1433	~~1430~~	240	35.40				
	1500	270	35.45				
	1530	300	35.45				
		330					
		360					
		390					
		420					
		450					
		480					
		510					
		540					
		570					
		600					
		660					
		720					
		780					
		840					
		900					
		960					
		1020					
		1080					
		1140					

Pumping Test Field Data Sheet

Well No. EW-10

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Elevation MP:

Remarks: Nitrogen start = 1037, 91% Start 1030

Phase of Test: Drawdown Recovery

Page: 1 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	0941	Static	36.30				
		0.5					
		1					
		2					
	1033	3	39.90			110	
		4					
		5					
	1036	6	39.97			110	
		7					
		8					
		9					
	1040	10	40.07			110	
		11					
		12					
		13					
		14					
	1045	15	40.15			110	
	1050	20	40.16			110	
	1055	25	40.21			110	
	1100	30	40.22			110	
	1105	35	40.25			110	
	1110	40	40.26			110	
	1115	45	40.27			110	
	1120	50	40.28			110	
	1130	60	40.27			110	
	1140	70	40.27			110	
	1150	80	40.30			110	
	1200	90	40.36			110	

Pumping Test Field Data Sheet

Well No. EW-1D

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 2 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
~~9/10~~ 9/7	1210	100	40.35			110	
9/7/10	1220	110	40.32			110	
	1230	120	40.32			110	
	1300	150	40.34			110	
	1330	180	40.35			110	
	1400	210	40.35			110	
	1430	240	40.35			110	
	1500	270	40.33			110	
	1530	300	40.33			110	
	1600	330	40.28			110	
	1630	360	40.22			110	
	1700	390	40.29			110	
	1730	420	40.25			110	
	1800	450	39.27			110	
	1830	480	38.80			110	
	1900	510	38.60			110	
	1930	540	38.53			110	
	2000	570	38.46			110	
	2030	600	38.48			110	
	2130	660	38.36			110	
	2230	720	38.3			110	
	2330	780	38.6			110	
9/8/10	030	840	38.87			110	
	130	900	38.31			110	
	230	960	38.20			110	
	330	1020	38.1			110	
	430	1080	37.57			110	
	530	1140	37.85			110	

Pumping Test Field Data Sheet

Well No. EW-1D

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 3 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/8/10	630	1200	40.30			110	
	0730	1260	40.20			110	
	0830	1320	40.30			110	
	0930	1380	40.32			110	
	1030	1440	40.37			110	24 hrs
	1130	1500	40.39			110	
	1230	1560	40.41			110	
	1330	1620	39.92			110	
	1430	1680	40.30			110	
	1530	1740	40.30			110	
	1630	1800	38.95			110	
	1730	1860	38.65			110	
	1830	1920	38.41			110	
	1931	1980	38.38			110	
	2031	2040	38.98			110	
	2131	2100	39.75			110	
	2230	2160	38.45			110	
	2330	2220	38.34			110	
9/9/10	030	2280	38.27			110	
	130	2340	38.16			110	
	0230	2400	38.14			110	
	0330	2460	39.15			110	
	430	2520	39.63			110	
	531	2580	38.85			110	
	631	2640	40.11			110	
	0730	2700	40.21			110	
	0830	2760	40.35			110	end
	0930	2820	40.41			110	

Pumping Test Field Data Sheet

Well No. EW-1D

Site: Old Roosevelt Field

Measured By:

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 4 of ___

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/9/10	1030	2880	40.57			110	
	1130	2940	40.60			110	
	1230	3000	40.58			110	
	1330	3060	40.54			110	
	1430	3120	40.52			110	
	1530	3180	40.44			110	
	1630	3240	40.35			110	
	1730	3300	40.11			110	
	1830	3360	38.90			110	
	1930	3420	38.56			110	
	2030	3480	38.38			110	
	2130	3540	38.28			110	
	2230	3600	38.22			110	
	2330	3660	39.30			110	
9/10/10	030	3720	39.65			110	
	130	3780	38.33			110	
	0230	3840	39.15			110	
	0330	3900	38.11			110	
	0430	3960	39.45			110	
	0530	4020	39.79			110	
	0630	4080	39.95			110	
	0730	4140	40.12			110	
	0830	4200	40.27			110	
	0930	4260	40.48			110	
	1030	4320	40.51				

Pumping Test Field Data Sheet

Well No. EW-1D

Site: Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

off @ 1030

Remarks: _____

Page: 1 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	—	Static	40.51				
	1030:30	0.5	~~36.37~~ 37.15				
	1031	1	37.08				
	1032	2	37.02				
	1033	3	36.98				
	1034	4	36.95				
	1035	5	36.90				
	1036	6	36.87				
	1037	7	36.88				
	1038	8	36.86				
	1039	9	36.85				
	1040	10	36.83				
	1041	11	36.77				
	1042	12	36.77				
	1043	13	36.75				
	1044	14	36.74				
	1045	15	36.73				
	1050	20	36.68				
	1055	25	36.65				
	1100	30	36.65				
	1105	35	36.63				
	1110	40	36.61				
	1115	45	36.58				
	1120	50	36.61				
	1130	60	36.60				
	1140	70	36.58				
	1150	80	36.58				
	1200	90	36.57				

Pumping Test Field Data Sheet

Well No. EW-1D

Site: Old Roosevelt Field

Measured By: _____

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 2 of ____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	1210	100	36.57				
	1220	110	36.58				
	1230	120	36.55				
	1300	150	35.54				
	1330	180	35.05				
	1400	210	36.02				
1433	~~1430~~	240	36.10				
	1500	270	36.31				
	1530	300	36.28				
		330					
		360					
		390					
		420					
		450					
		480					
		510					
		540					
		570					
		600					
		660					
		720					
		780					
		840					
		900					
		960					
		1020					
		1080					
		1140					

Pumping Test Field Data Sheet

Well No. GWP-10

Site: Old Roosevelt Field

Measured By: John N. Doughtery / Lee remarks

Distance to Pumping Well: _____

Phase of Test: Drawdown / Recovery

Elevation MP: _____

Remarks: _____

Page: 1 of 5

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
	CM 9/8/10						CM 9/8/10
9/7/10	~~1049~~ 1049	Static	101.6	—		~~Ø~~	Pump off. on.
"	1030.5	0.5	101.62			Ø 9/8/10	Test Start at 1030
9/7/10	1031	1	101.62				Readings by Dough
	1032	2	101.67				
	1033	3	101.67				
	1034	4	101.73				
	1035	5	101.62				
	1036	6	101.64				
	1037	7	101.64				
	1038	8	101.64				
	1039	9	101.65				
	1040	10	101.64			Flow meter not working	
	—	11	—				
	—	12	—				
	1043	13	101.76				
	1044	14	101.78				
	1046	15	101.8				
	1050	20	101.66				
	—	25	—			Ø 9/8/10	
	1100	30	101.71				CM 9/8/10
	1105	35	101.75			Ø	Pump off. on
	1110	40	101.74				Flow Meter not working
	1115	45	101.74				
	1120	50	101.8			Ø 9/8/10	
	1130	60	101.8			Ø	Mike Shirt starts recording
	1140	70	101.80				
	1150	80	101.64				
↓	1200	90	101.80				

Pumping Test Field Data Sheet

Well No. BUNG. 10

Site: Old Roosevelt Field

Measured By: Alec Demakis

Distance to Pumping Well: _____

Phase of Test: (Drawdown) Recovery

Elevation MP: _____

Remarks: _____

Page: 2 of 5

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	12[10]	100	101.94			Ø	
	12[20]	110	101.91				
	12[30]	120	101.97				
		150	101				
		180					
	1426	210					
	~~1430~~ JHE	240	101.87			Ø	
		270					
		300					
		330					
	1625	360	101.81				~~off~~ Pump ON.
		390					
		420					
		450					~~off~~
	1855	480	40.19			Ø	~~off~~ Pump off
		510					
		540					
		570					
	2030	600	39.56			Ø	~~off~~ Pump off
		660					
		720					
		780	ON 9/8/10				Pump ON 9/8/10
↓	2230	~~720~~ 840	39.48			Ø	~~off~~
		~~900~~					
		960	ON 9/8/10				
		~~1020~~	40	ON 9/8/10			Pump ON 9/8/10
9/9/10	0033	~~1080~~	40.33			Ø	~~off~~
		~~1140~~	ON 9/8/10				

Pumping Test Field Data Sheet

Well No. Bldg 10 GWP-10

Site: Old Roosevelt Field

Measured By: see remarks

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 3 of 5

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/8/10		~~1200~~					
		~~1260~~	AM 9/9/10				Pump
	0230	96~~1320~~	39.45			~~Ø~~	^ off
		~~1380~~					
		1440					
		~~1500~~	1080	AM 9/8/10			
	0430	~~1560~~	101.46			Ø	~~off~~ Pump ON
		~~1620~~					AM 9/8/10
		1680	AM 9/8/10				
		~~1740~~	(1200)	AM 9/8/10			
	0630	~~1800~~	101.65			Ø	~~off~~ Pump on.
	0826	~~1860~~	101.71			Ø	~~off~~ Pump on.
		~~1920~~	(1320)	AM 9/8/10			AM 9/8/10
		1980					
		2040					
		2100					
		2160					
		2220					
		2280					
		2340					
		2400		AM 9/8/10			
		2460					
		2520					
		2580					
		2640					
		2700					
		2760					
		2820					

Pumping Test Field Data Sheet

Well No. GWP-10

Site: Old Roosevelt Field

Measured By: see remarks

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 4 of 5

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
~~9/8/10~~		~~1200~~					
		~~1260~~			~~9/9/10~~		
		~~1320~~					
		~~1380~~					
9/8/10	1038	1440	101.88				PUMP ON JR.
		1500					
"	1235	1560	101.87				PUMP ON JR.
		1620					
	1424	1680	101.82				Pump on JR
		1740					
	1626	1800	40.41				Pump off JR
		1860					
	1824	1920	39.69				Pump. off JR
		1980					
	2026	2040	100.98				PUMP ON EK
	—	2100					
	2229	2160	39.97				PUMP OFF EK
		2220					
9/9/10	0025	2280	38.05				PUMP OFF EK
		2340					
"	0225	2400	39.35				PUMP OFF EK
		2460					
"	0424	2520	101.53				PUMP ON EK
		2580					
	0625	2640	101.73				PUMP ON EK
		2700					
	0825	2760	101.85				Pump on JR
		2820					

Pumping Test Field Data Sheet

Well No. GWP-10

Site: Old Roosevelt Field

Measured By: see remarks

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks: SOLINST serial #4402

Page: 5 of 5

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/9/10	1025	2880	101.92				Pump ON TR
		2940					
	1225	3000	102.00				Pump ON TR
		3060					
	1425	3120	102.00				Pump on TR
		3180					
	1627	3240	101.89				Pump on TR
		3300					
	1824	3360	40.13				Pump off TR
		3420					
	2025	3480	39.60				PUMP OFF ER
		3540					
	2226	3600	39.36				PUMP OFF ER
		3660					
9/10/10	0024	3720	101.58				PUMP ON ER
		3780					
	0225	3840	39.14				PUMP OFF ER
		3900					
	0425	3960	101.42				PUMP ON ER
	~~00~~	4020					
	0624	4080	101.69				PUMP ON ER
		4140					
	0826	4200	101.88				Pump ON TR
		4260					
	1010	4320	101.94				Pump on TR

Pumping Test Field Data Sheet

Well No. GWP-10

Site: Old Roosevelt Field

Measured By: JNDOUGHERTY

Distance to Pumping Well: /

Phase of Test: Drawdown ~~Recovery~~

Elevation MP: _____

Page: 1 of 2

Remarks: _____

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/11	1030	Static	/				Stop TEST.
	1030.5	0.5	/				
	1031	1	/				
	1032	2	/				
	1033	3	/				GWP-10
	1034	4	101.85				Pump ON.
	1035	5	101.84				JNDOUGHERTY
	1036	6	101.89				Pump ON @
	1037	7	101.9				
	1038	8	—				
	1039	9	101.91				
	1040	10	—				
	1041	11	—				
	1042	12	101.88				
	1043	13	101.88				
	1044	14	101.85				
	1045	15	101.8				
	1050	20	101.94				
	1055	25	101.85				
	1100	30	101.75				
	1105	35	101.8				
	1110	40	101.73				
	1115	45	101.81				
	1120	50	101.82				
	1130	60	101.76				
	1140	70	101.69				
	1150	80	101.67				
	1200	90	101.75				

Pumping Test Field Data Sheet

Well No. GWP-10

Site: Old Roosevelt Field

Measured By: JN Dougherty

Distance to Pumping Well:

Phase of Test: Drawdown / Recovery

Elevation MP:

Remarks:

Page: 2 of 2

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10	1210	100	101.75				GWP-10 ON.
	1223	110	101.76				"
	1233	120	101.69				"
		150					
		180					
		210					
	1422	240	101.54				GWP-10 ON FR
		270					
		300					
	1700	330	101.67				Pump. ON. "
9/10/10	1705	360	Pump OFF				END OF READINGS.
		390					
		420					
		450					
		480					
		510					
		540					
		570					
		600					
		660					
		720					
		780					
		840					
		900					
		960					
		1020					
		1080					
		1140					

9/10/10

" 9/10/10

9/10/10

101.67

Pumping Test Field Data Sheet

Well No. GWP-11

Site: Old Roosevelt Field

Measured By: Allan Hunter / see remarks SOLAST SEL A-00503

Distance to Pumping Well: _____

Phase of Test: Drawdown Recovery

Elevation MP: _____

Remarks: _____

Page: 1 of 4

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9-7-10	10:12	Static	76.2			1210	
	10:30	0.5					Start test
9-7-10	10:32	2	76.29			1209	
		2					
9-7-10	10:34	4	76.31			1208	
9-7-10	10:38	8	76.3			1208	
9-7-10	10:43	13	76.37			1207	
9-7-10	10:49	19	76.37			1207	
9-7-10	10:56	26	76.42			1207	
9-7-10	10:57	27	76.4			1207	
		9	~~76.4~~	A.H. 9/7/10			
9-7-10	11:00	30	76.4			1207	
		11	~~76.42~~	A.H. 9/7/10			
9-7-10	11:02	32	76.42			1209	
		13					
		14					
9-7-10	11:07	37	76.47			1207	
9-7-10	11:12	42	76.46			1206	
9-7-10	11:17	47	76.46			1207	
9-7-10	11:22	52	76.45			1208	
9-7-10	11:27	57	76.46			1208	
9-7-10	11:32	62	76.54			1208	
		45					
		50					A.H. 9/7/10
		60					
9/7/10	11:40	70	76.53				
	11:50	80	76.46			1207	
	12:00	90	76.56			1207	

Pumping Test Field Data Sheet

Well No. GWP-11

Site: Old Roosevelt Field

Measured By: See remarks

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 2 of 4

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/7/10	12:10	100	76.51			1209	A. Hunter
	12:20	110	76.54			1208	
	12:30	120	76.54			1208	
		150	~~76.52~~				
		180					
		210					
	1430	240	76.52			1208	
		270					
		300					
		330					
Day 1	1628	360	76.43			1208	
		390					
		420					
		450					
	1830	480	73.30			1231	
		510					
		540					
		570					
	2032	600	72.83			1233	
		660					
	2232	720	72.68			1235	
		780					
9/8/10	037	840	73.26			1231	
		900					
	234	960	72.66			1236	
Day 2		1020					
	458	1080	75.65			1215	
		1140					

Pumping Test Field Data Sheet

Well No. 6WP-11 ✓

Site: Old Roosevelt Field

Measured By: Per remarks

Distance to Pumping Well: _____

Phase of Test: (Drawdown) Recovery

Elevation MP: _____

Remarks: _____

Page: 3 of 4

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/8/10	1632	1200	~~76.22~~			1210	
		1260					
	0830	1320	76.44			1210	F. Robinson.
		1380					
	1044	1440	~~76.52~~			1206	AND.
		1500					
	1237	1560	76.53			1206	AND.
		1620					
	1428	1680	76.42			1209	FR
		1740					
	1630	1800	73.41			1230	FR
		1860					
	1828	1920	72.83			1233	FR
		1980					
	2032	2040	~~75.28~~			1219	ME
		2100					
	2233	2160	73.11			1232	ME
		2220					
9/9/10	0033	2280	~~72.75~~			1234	ME
		2340					
9/9/10	0234	2400	~~72.62~~			1236	ME
		2460					
	0432	2520	~~75.95~~			1214	ME
		2580					
	0634	2640	~~76.20~~			1210	ME
		2700					
	0829	2760	76.49			1210	FR
	~~0829~~	~~2820~~	~~76.49~~			~~1210~~	~~FR~~ FR

0.55

Pumping Test Field Data Sheet

Well No. GWP-11

Site: Old Roosevelt Field

Measured By: see remarks

Distance to Pumping Well:

Phase of Test: (Drawdown) Recovery

Elevation MP:

Remarks:

Page: 4 of 4

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/9/10	1028	2880	76.66			1208	FR
		2940					
	1228	3000	76.78			1208	FR
		3060					
	1428	3120	76.65			1207	FR
		3180					
	1630	3240	76.51			1207	FR
		3300					
	1828	3360	73.29			1233	FR
		3420					
	2032	3480	72.80			1234	MF
		3540					
	2233	3600	72.63			1232	MF
		3660					
9/10/10	0031	3720	75.90			1214	MF
		3780					
	230	3840	72.65			1236	MF
		3900					
	431	3960	75.65			1216	MF
		4020					
	630	4080	76.03			1207	MF
		4140					
	0829	4200	76.49			1210	FR
		4260					
	1013	4320	76.56			1208	FR

Pumping Test Field Data Sheet

Well No. GWP-11

Site: Old Roosevelt Field

Measured By: Allan Hunter

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 1 of 2

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
9/10/10		Static					Stop Test
		0.5					
		1					
		2					observations
	1033	3	76.48				by A. Hunter
		4					
	1035	5	76.52				
	1036	6	76.52				
	1037	7	76.5			1209	
		8					
	1039	9	76.51			1205	
	1040	10	76.55				
	1041	11	76.55			1207	
	—	12	—				
	1043	13	76.52			1207	
	1044	14	76.46			1206	
	1045	15	76.44			1207	
	1050	20	76.47				
A.H. 9/10	1055	25	76.47	A.H. 9/10		1207	
	1100	30	76.42			1209	
11/10	1105	35	76.42			1207	
A.H. 9/10	1110	40	7638 76.47	A.H. 9/10		1207	
	1115	45	76.41			1207	
	1120	50	76.4			1207	
	1130	60	76.39			1207	
	1140	70	76.35			1205	
	1150	80	76.35			1205	
	1200	90	76.36			1207	

Pumping Test Field Data Sheet

Well No. GWB-11

Site: Old Roosevelt Field

Measured By: Allan Hunter/Lee Remarks

Distance to Pumping Well: _____

Phase of Test: Drawdown (Recovery)

Elevation MP: _____

Remarks: _____

Page: 2 of 2

Date	Time	Elapsed Time (min)	DTW (ft)	Drawdown (ft)	Orifice Pressure (in)	Pumping Rate (gpm)	Remarks
	1210	100	76.34			1207	A.H.
	1220	110	76.29			1207	A.H.
	1230	120	76.36			1208	A.H.
		150					
		180					
		210					
	1425	240	76.02			1212	F.R.
		270					
		300					
	1712	330	74.02			1225	A.H.
		360					End of
		390					Observations
		420					
		450					
		480					
		510					
		540					
		570					
		600					
		660		A.H.	9/10/2010		
		720					
		780					
		840					
		900					
		960					
		1020					
		1080					
		1140					

Appendix E

Weather Data

Lat: N 40 ° 45 ' 3 " (40.751 °)
Lon: W 73 ° 36 ' 47 " (-73.613 °)
Elevation (ft): 115
MADIS ID: AT063
Hardware: Davis Vantage Pro
Weather Station Software: WeatherDisplay:10.37

KNYCARLE1

Carle Place, Carle Place, NY

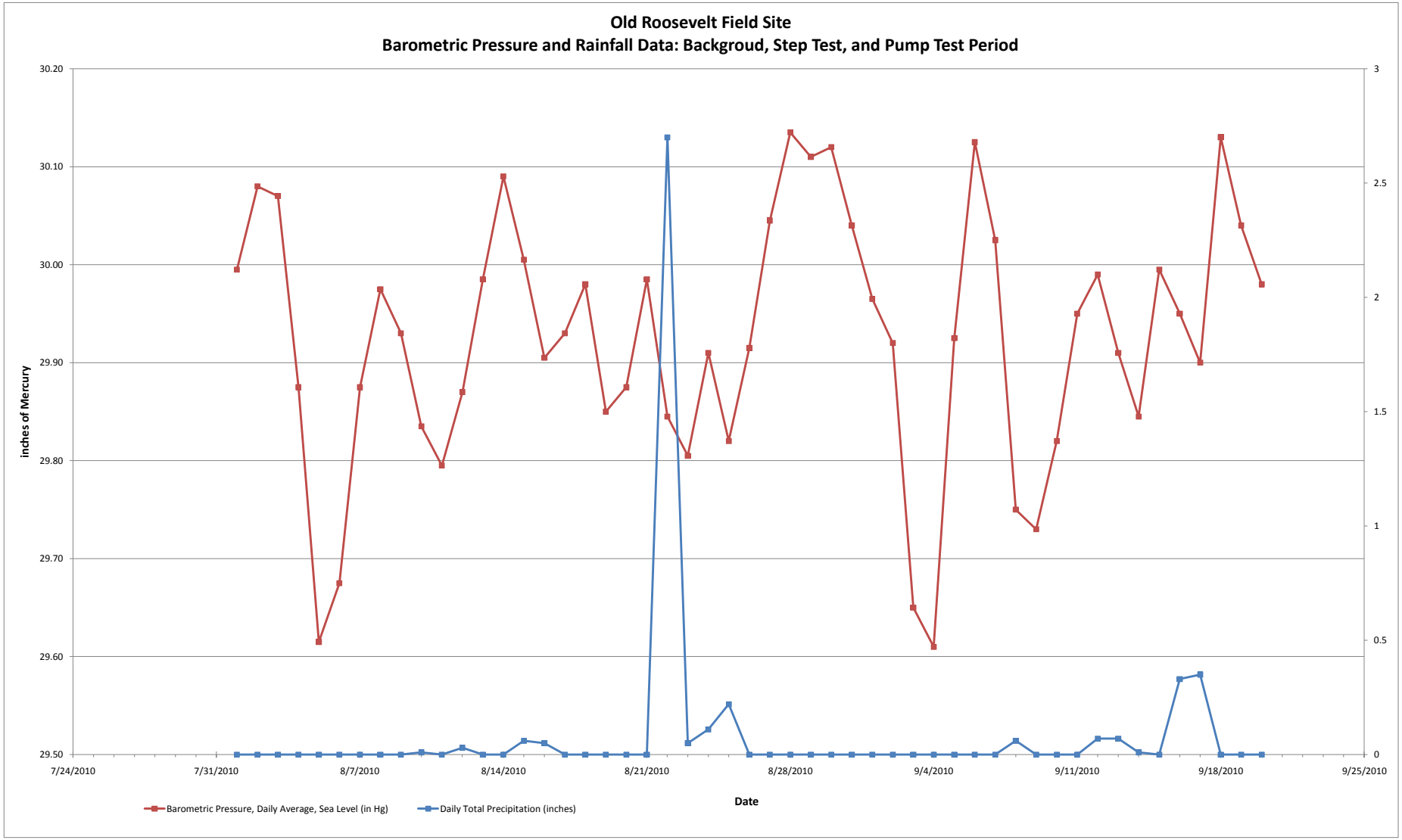
2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Barometric Pressure, Daily Average, Sea Level (in Hg)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Daily Total Precipitation (inches)
August	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
8/1/2010	79	72	65	62	58	52	83	63	41	30.06	30.00	29.93	-	-	-	7	2	14	0
8/2/2010	81	75	68	64	61	54	87	64	43	30.11	30.08	30.05	-	-	-	8	3	18	0
8/3/2010	81	77	72	65	63	60	73	62	57	30.09	30.07	30.05	-	-	-	6	4	16	0
8/4/2010	87	82	76	73	69	64	87	67	57	30.05	29.88	29.7	-	-	-	9	5	18	0
8/5/2010	93	84	75	74	70	63	93	65	37	29.7	29.62	29.53	-	-	-	14	3	26	0
8/6/2010	87	81	66	70	59	44	83	51	25	29.79	29.68	29.56	-	-	-	8	2	18	0
8/7/2010	82	72	59	69	56	50	84	61	35	29.95	29.88	29.8	-	-	-	9	2	17	0
8/8/2010	86	77	69	73	67	57	92	73	38	30.01	29.98	29.94	-	-	-	10	3	20	0
8/9/2010	89	80	72	73	68	59	96	70	44	29.98	29.93	29.88	-	-	-	9	3	20	0
8/10/2010	90	81	74	72	67	62	86	62	43	29.89	29.84	29.78	-	-	-	6	1	14	0.01
8/11/2010	89	78	72	72	68	62	95	73	41	29.83	29.80	29.76	-	-	-	7	2	13	0
8/12/2010	76	73	70	69	65	61	94	77	61	29.92	29.87	29.82	-	-	-	6	1	12	0.03
8/13/2010	78	72	67	62	57	51	85	60	40	30.05	29.99	29.92	-	-	-	8	2	16	0
8/14/2010	76	68	56	61	55	48	93	65	41	30.12	30.09	30.06	-	-	-	8	2	14	0
8/15/2010	76	71	62	69	63	60	96	77	58	30.06	30.01	29.95	-	-	-	9	3	20	0.06
8/16/2010	83	76	69	74	71	63	96	86	71	29.95	29.91	29.86	-	-	-	7	2	14	0.05
8/17/2010	90	80	72	74	68	58	99	70	36	29.97	29.93	29.89	-	-	-	7	1	116	0
8/18/2010	77	76	72	66	59	55	76	57	47	30.04	29.98	29.92	-	-	-	2	1	6	0
8/19/2010	87	76	64	68	61	54	99	64	34	29.92	29.85	29.78	-	-	-	10	2	14	0
8/20/2010	88	78	66	68	60	44	96	59	23	29.95	29.88	29.8	-	-	-	6	2	14	0
8/21/2010	80	74	62	63	58	48	80	58	45	30.02	29.99	29.95	-	-	-	7	2	13	0
8/22/2010	79	75	70	75	72	69	100	92	78	29.97	29.85	29.72	-	-	-	14	4	24	2.7
8/23/2010	72	69	67	72	67	60	100	93	76	29.9	29.81	29.71	-	-	-	9	5	20	0.05
8/24/2010	68	66	62	63	60	58	95	82	74	29.96	29.91	29.86	-	-	-	8	5	21	0.11
8/25/2010	67	66	63	65	64	62	99	95	94	29.86	29.82	29.78	-	-	-	7	2	16	0.22
8/26/2010	81	73	65	65	59	50	91	64	34	30	29.92	29.83	-	-	-	9	2	18	0
8/27/2010	78	68	56	54	51	46	92	59	35	30.09	30.05	30	-	-	-	8	2	14	0
8/28/2010	78	68	54	62	54	51	95	64	39	30.18	30.14	30.09	-	-	-	7	2	12	0
8/29/2010	93	76	58	63	58	50	96	60	24	30.17	30.11	30.05	-	-	-	7	1	10	0
8/30/2010	90	77	61	64	59	53	95	59	29	30.17	30.12	30.07	-	-	-	7	2	14	0
8/31/2010	94	81	66	67	63	59	90	59	32	30.11	30.04	29.97	-	-	-	7	1	13	0
9/1/2010	93	82	70	69	65	55	91	60	29	30.02	29.97	29.91	-	-	-	7	1	12	0
9/2/2010	89	81	74	70	66	61	77	62	45	29.96	29.92	29.88	-	-	-	9	2	22	0
9/3/2010	82	77	72	74	70	64	93	79	65	29.88	29.65	29.42	-	-	-	7	2	17	0
9/4/2010	79	74	66	68	50	40	80	44	28	29.8	29.61	29.42	-	-	-	18	6	28	0
9/5/2010	76	66	54	50	43	38	78	46	27	30.05	29.93	29.8	-	-	-	12	3	24	0
9/6/2010	76	66	50	61	50	40	94	61	29	30.2	30.13	30.05	-	-	-	9	2	16	0
9/7/2010	82	74	66	68	64	58	83	72	53	30.15	30.03	29.9	-	-	-	12	4	21	0
9/8/2010	89	76	65	69	57	40	86	56	19	29.91	29.75	29.59	-	-	-	9	4	24	0.06
9/9/2010	71	65	62	50	49	48	64	57	46	29.77	29.73	29.69	-	-	-	12	5	22	0
9/10/2010	71	64	59	53	50	48	75	61	47	29.9	29.82	29.74	-	-	-	7	2	16	0
9/11/2010	77	66	53	57	51	46	92	62	38	30	29.95	29.9	-	-	-	7	2	13	0
9/12/2010	66	62	58	58	56	52	96	80	63	30.02	29.99	29.96	-	-	-	5	2	13	0.07
9/13/2010	72	63	60	62	59	57	100	89	59	30	29.91	29.82	-	-	-	5	1	12	0.07
9/14/2010	76	66	56	62	51	42	99	65	32	29.87	29.85	29.82	-	-	-	12	2	20	0.01
9/15/2010	70	66	57	45	44	41	61	44	36	30.12	30.00	29.87	-	-	-	8	3	18	0
9/16/2010	72	62	49	68	55	43	97	80	55	30.14	29.95	29.76	-	-	-	9	3	21	0.33
9/17/2010	71	66	59	67	59	49	99	78	53	30.09	29.90	29.71	-	-	-	7	2	14	0.35
9/18/2010	70	63	58	56	54	51	90	72	54	30.18	30.13	30.08	-	-	-	6	1	13	0

Lat: N 40 ° 45 ' 3 " (40.751 °)
Lon: W 73 ° 36 ' 47 " (-73.613 °)
Elevation (ft): 115
MADIS ID: AT063
Hardware: Davis Vantage Pro
Weather Station Software: WeatherDisplay:10.37

KNYCARLE1

Carle Place, Carle Place, NY

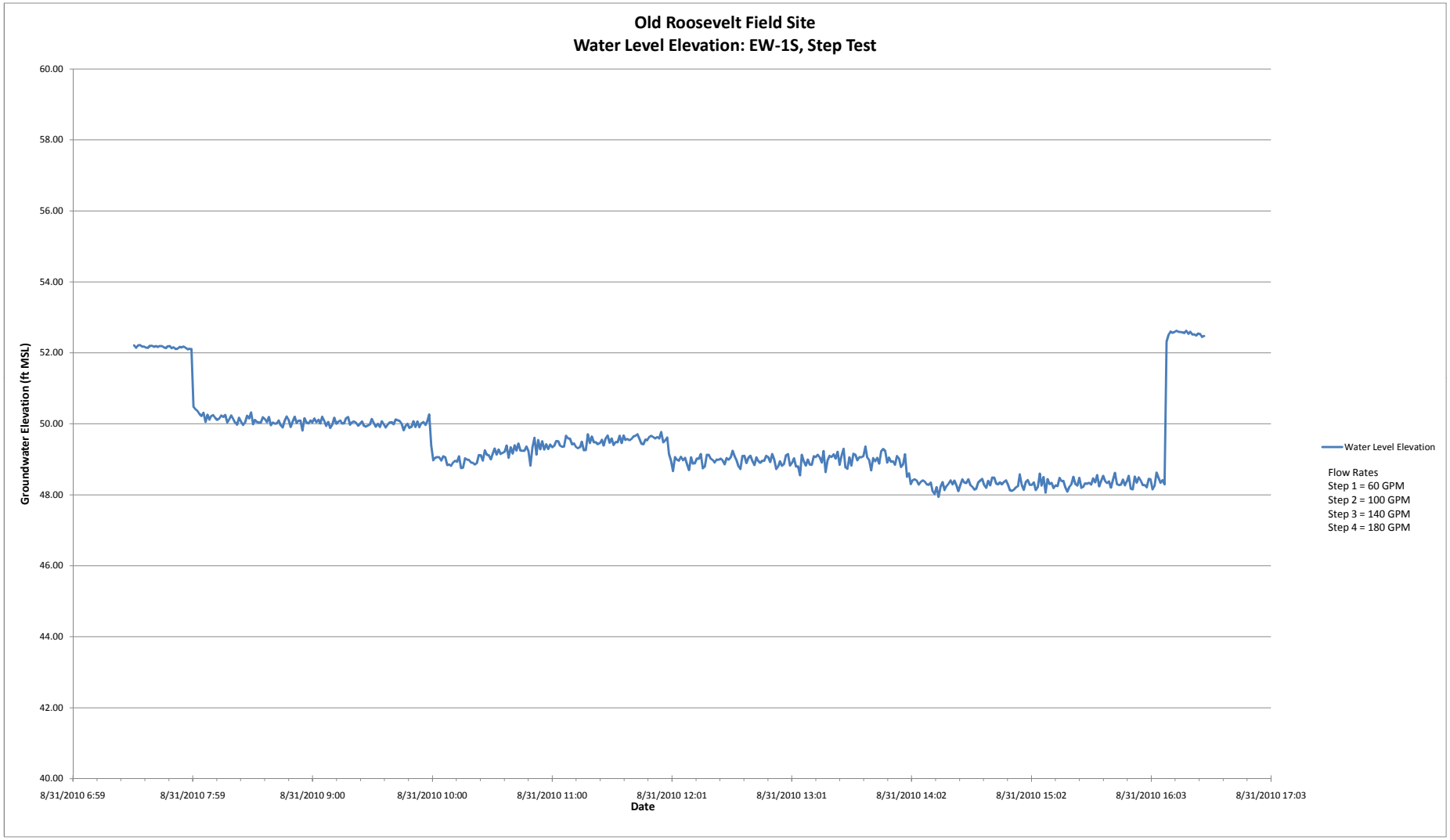
2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Barometric Pressure, Daily Average, Sea Level (in Hg)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Daily Total Precipitation (inches)
9/19/2010	77	66	54	63	58	53	99	76	53	30.14	30.04	29.94	-	-	-	5	1	10	0
9/20/2010	71	65	55	62	48	40	83	58	33	30.07	29.98	29.89	-	-	-	8	3	20	0

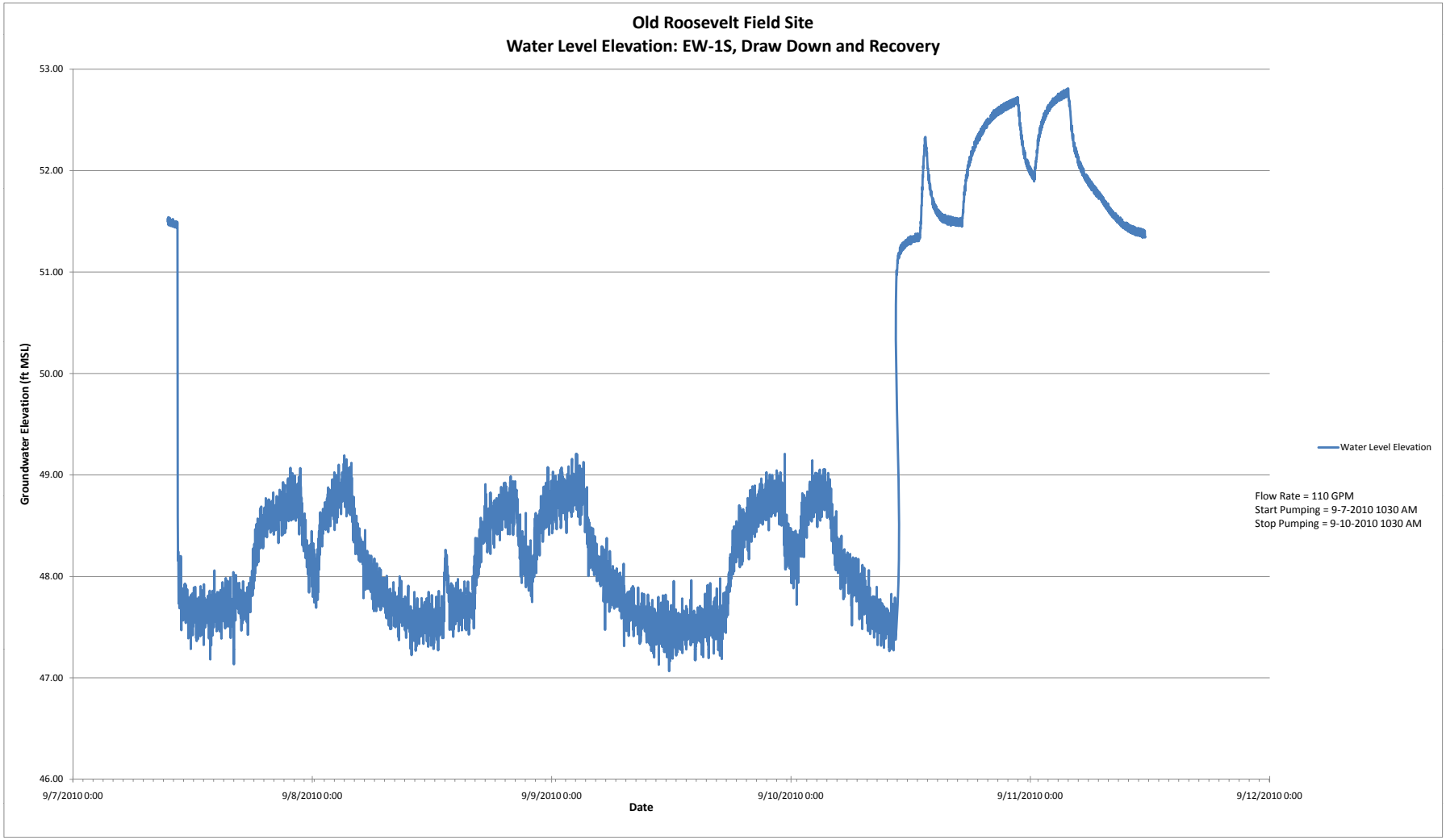

Old Roosevelt Field Site
Barometric Pressure and Rainfall Data: Backgroud, Step Test, and Pump Test Period
inches of Mercury
30.20
30.10
30.00
29.90
29.80
29.70
29.60
29.50
3
2.5
2
1.5
1
0.5
0
7/24/2010
7/31/2010
8/7/2010
8/14/2010
8/21/2010
8/28/2010
9/4/2010
9/11/2010
9/18/2010
9/25/2010
Date
Barometric Pressure, Daily Average, Sea Level (in Hg)
Daily Total Precipitation (inches)

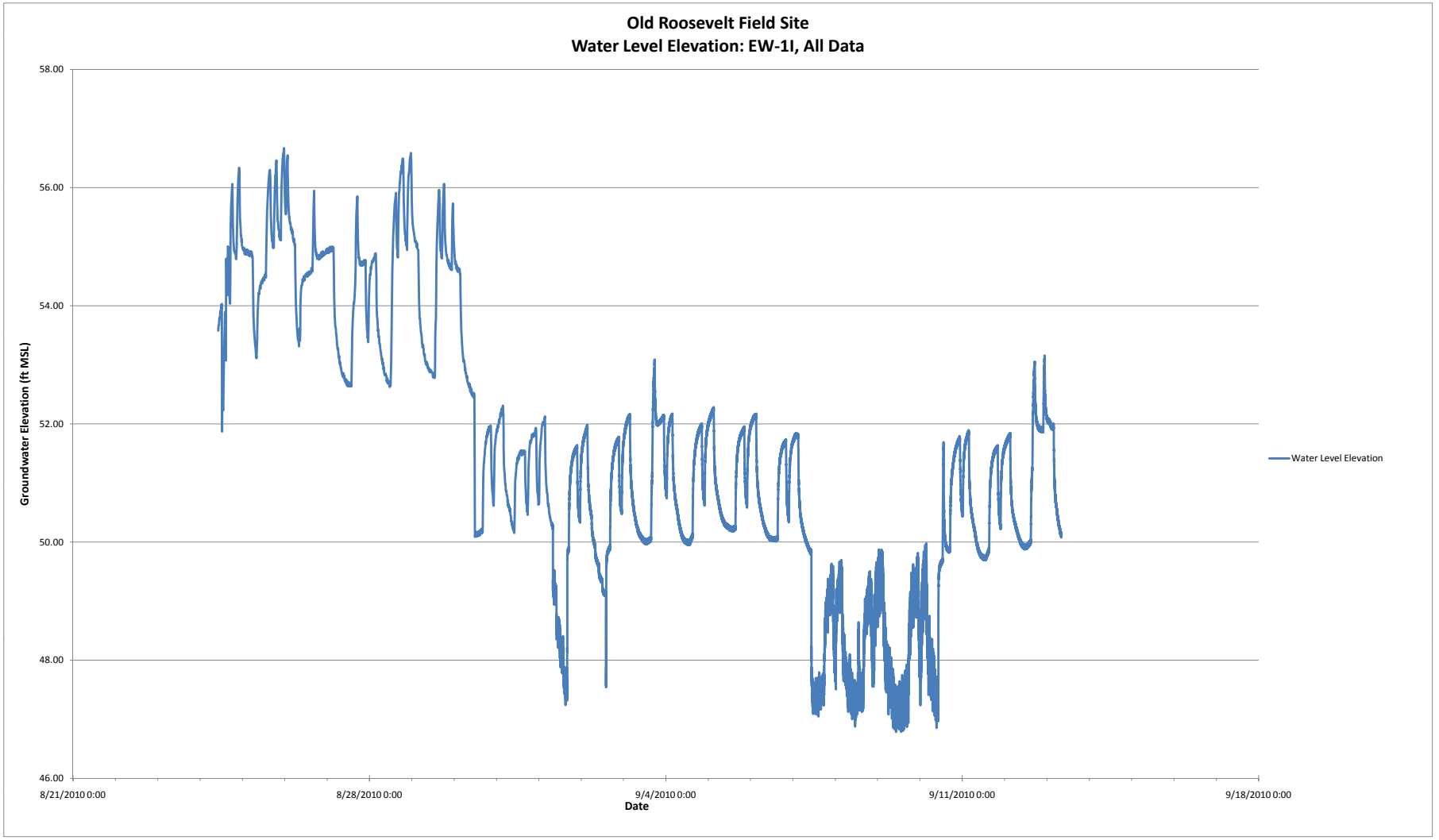
Appendix F

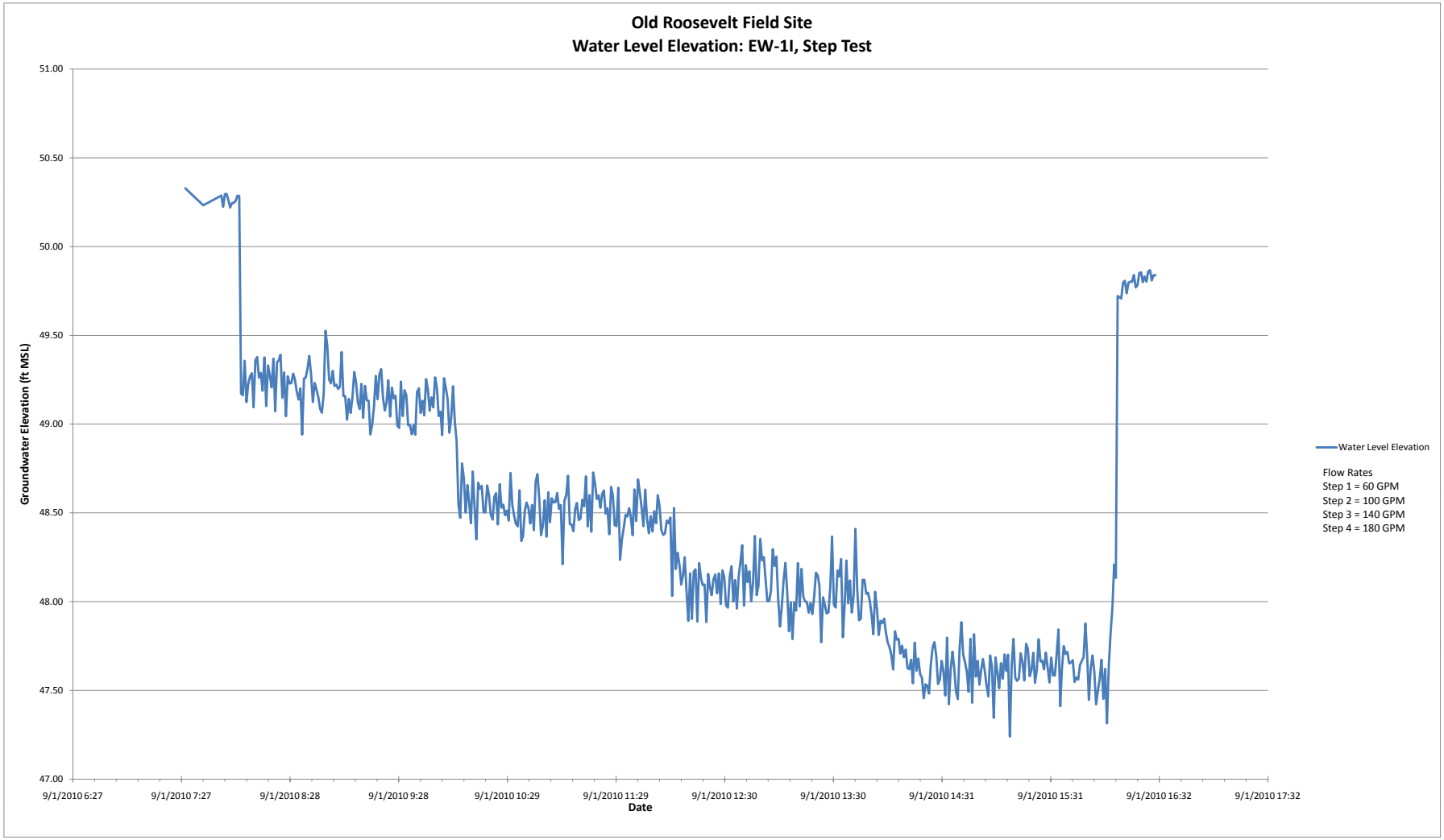
Water Level Data Graphs

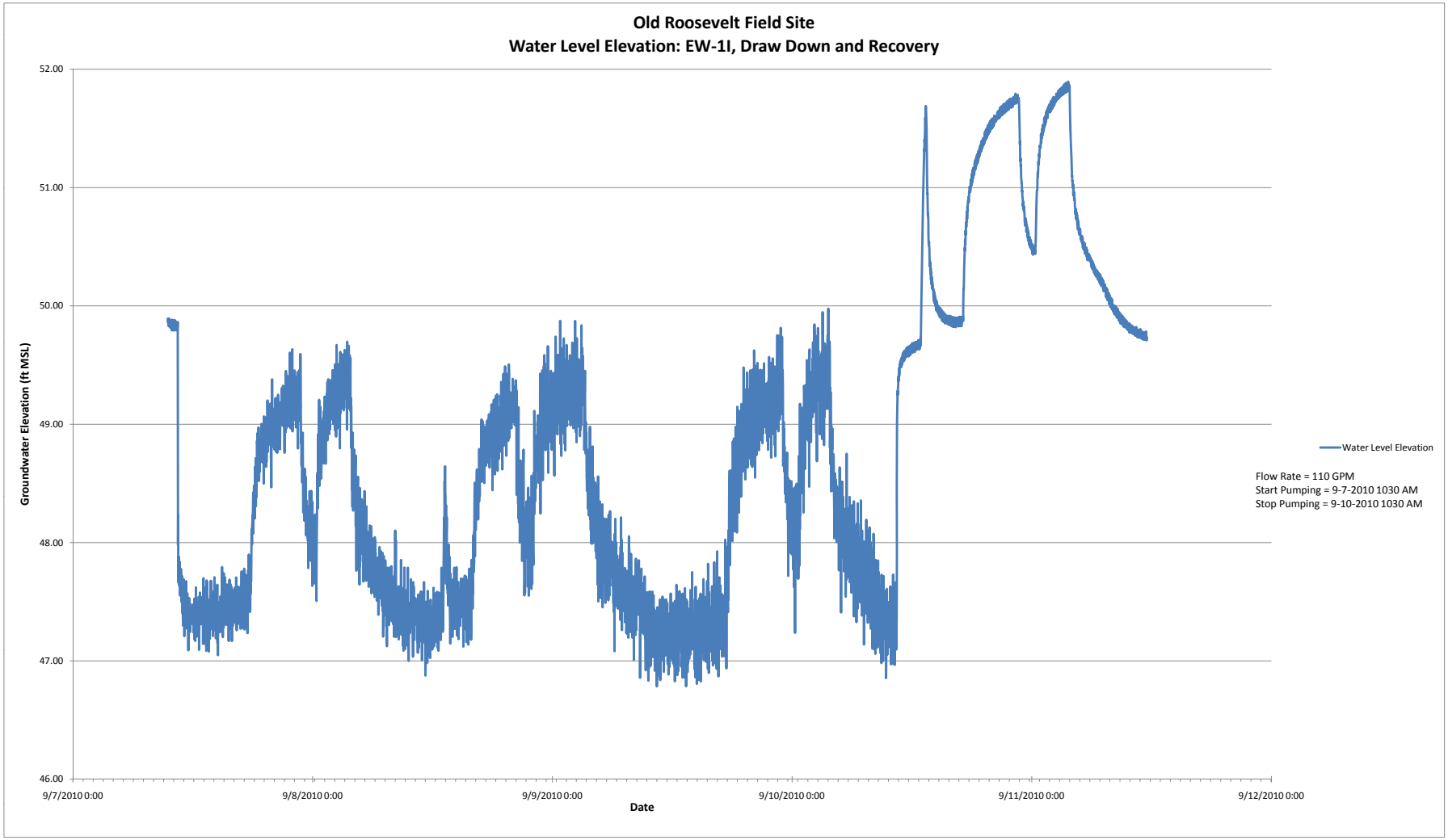

Old Roosevelt Field Site
Water Level Elevation: EW-1S, All Data
60.00
58.00
56.00
54.00
52.00
50.00
48.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation

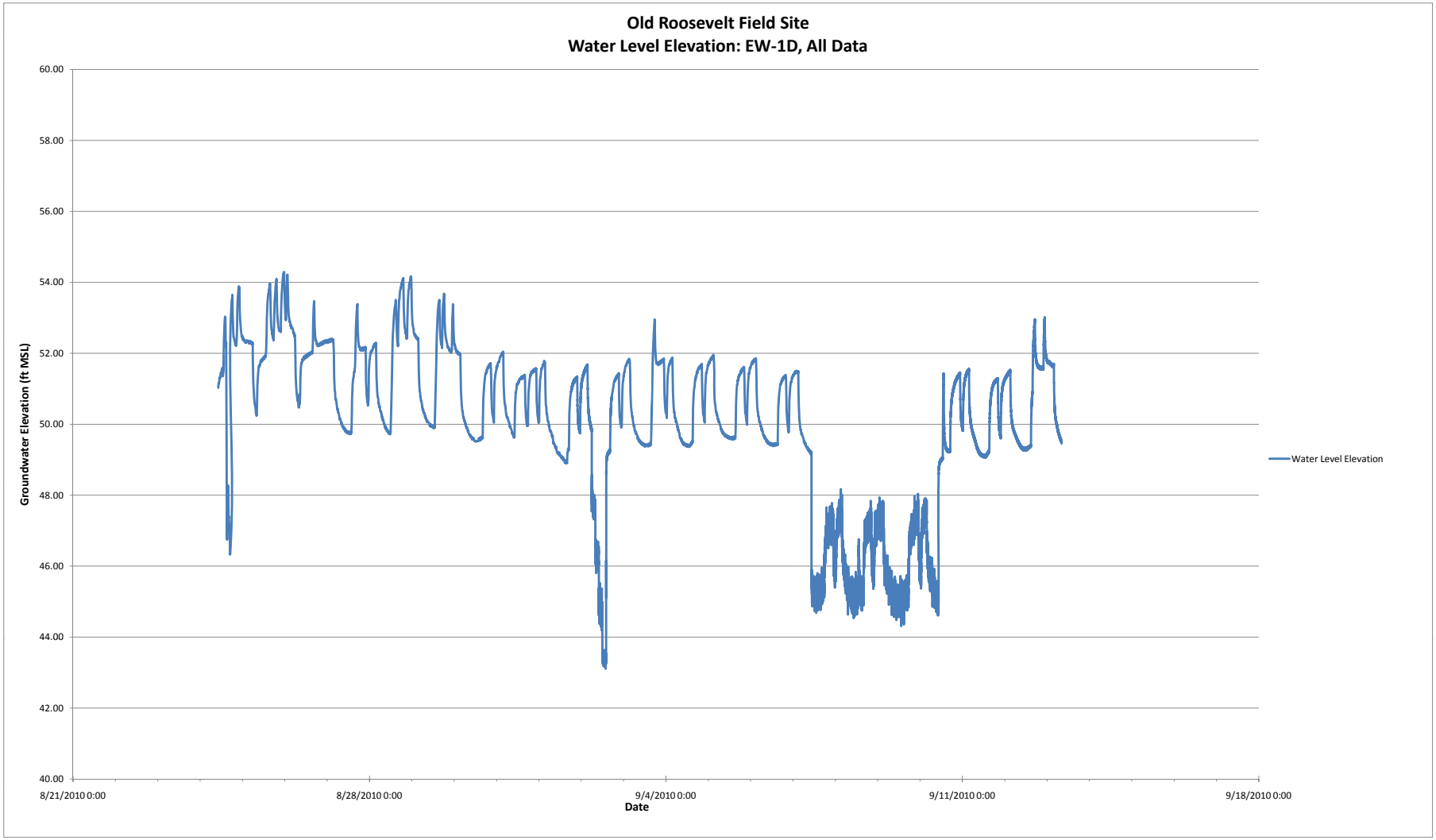

Old Roosevelt Field Site
Water Level Elevation: EW-1S, Step Test
Groundwater Elevation (ft MSL)
60.00
58.00
56.00
54.00
52.00
50.00
48.00
46.00
44.00
42.00
40.00
8/31/2010 6:59
8/31/2010 7:59
8/31/2010 9:00
8/31/2010 10:00
8/31/2010 11:00
8/31/2010 12:01
8/31/2010 13:01
8/31/2010 14:02
8/31/2010 15:02
8/31/2010 16:03
8/31/2010 17:03
Date
Water Level Elevation
Flow Rates
Step 1 = 60 GPM
Step 2 = 100 GPM
Step 3 = 140 GPM
Step 4 = 180 GPM

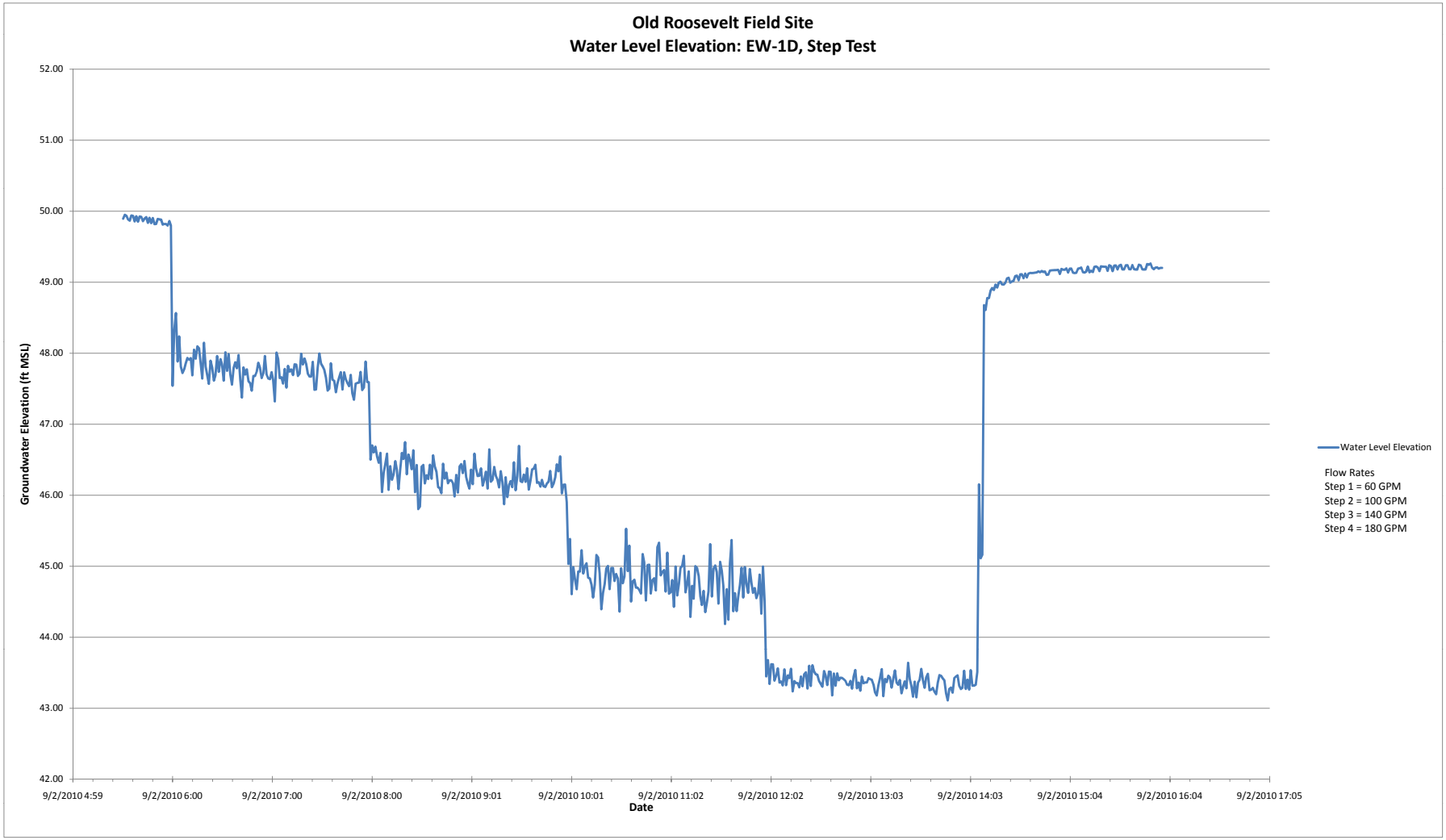

Old Roosevelt Field Site
Water Level Elevation: EW-1S, Draw Down and Recovery
Groundwater Elevation (ft MSL)
53.00
52.00
51.00
50.00
49.00
48.00
47.00
46.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

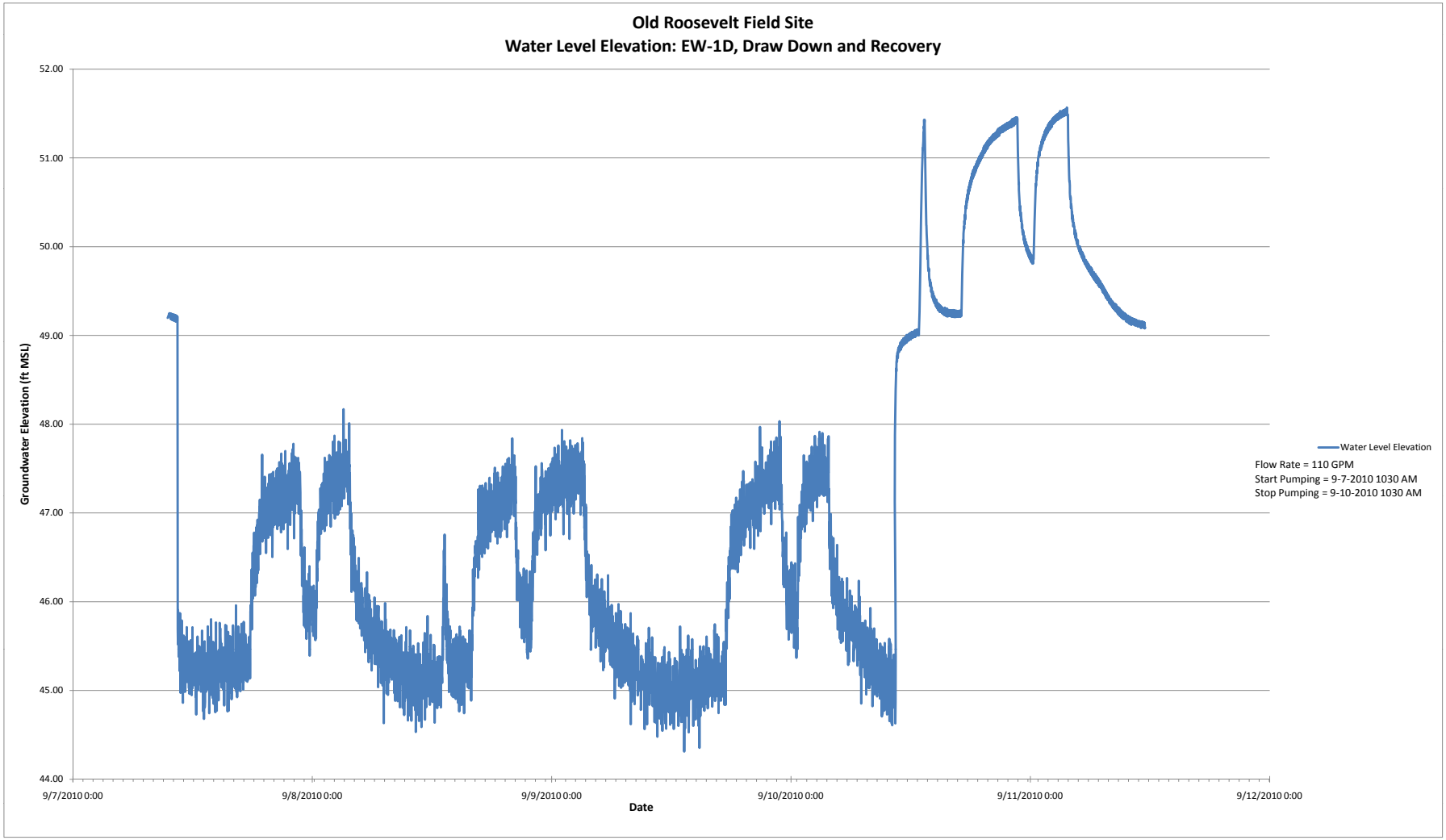

Old Roosevelt Field Site
Water Level Elevation: EW-1I, All Data
58.00
56.00
54.00
52.00
50.00
48.00
46.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation

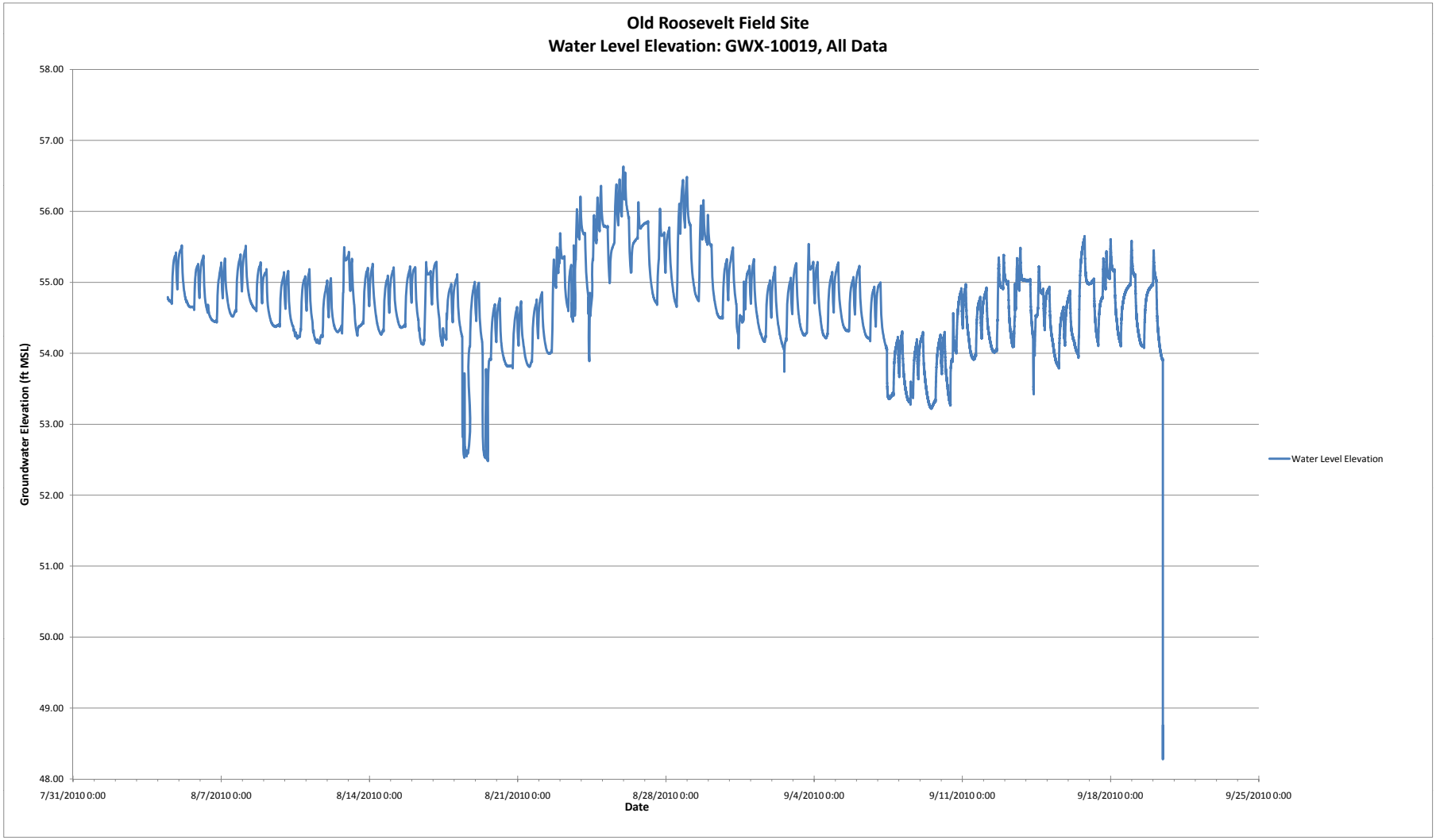

Old Roosevelt Field Site
Water Level Elevation: EW-1I, Step Test
Groundwater Elevation (ft MSL)
51.00
50.50
50.00
49.50
49.00
48.50
48.00
47.50
47.00
9/1/2010 6:27
9/1/2010 7:27
9/1/2010 8:28
9/1/2010 9:28
9/1/2010 10:29
9/1/2010 11:29
9/1/2010 12:30
9/1/2010 13:30
9/1/2010 14:31
9/1/2010 15:31
9/1/2010 16:32
9/1/2010 17:32
Date
Water Level Elevation
Flow Rates
Step 1 = 60 GPM
Step 2 = 100 GPM
Step 3 = 140 GPM
Step 4 = 180 GPM

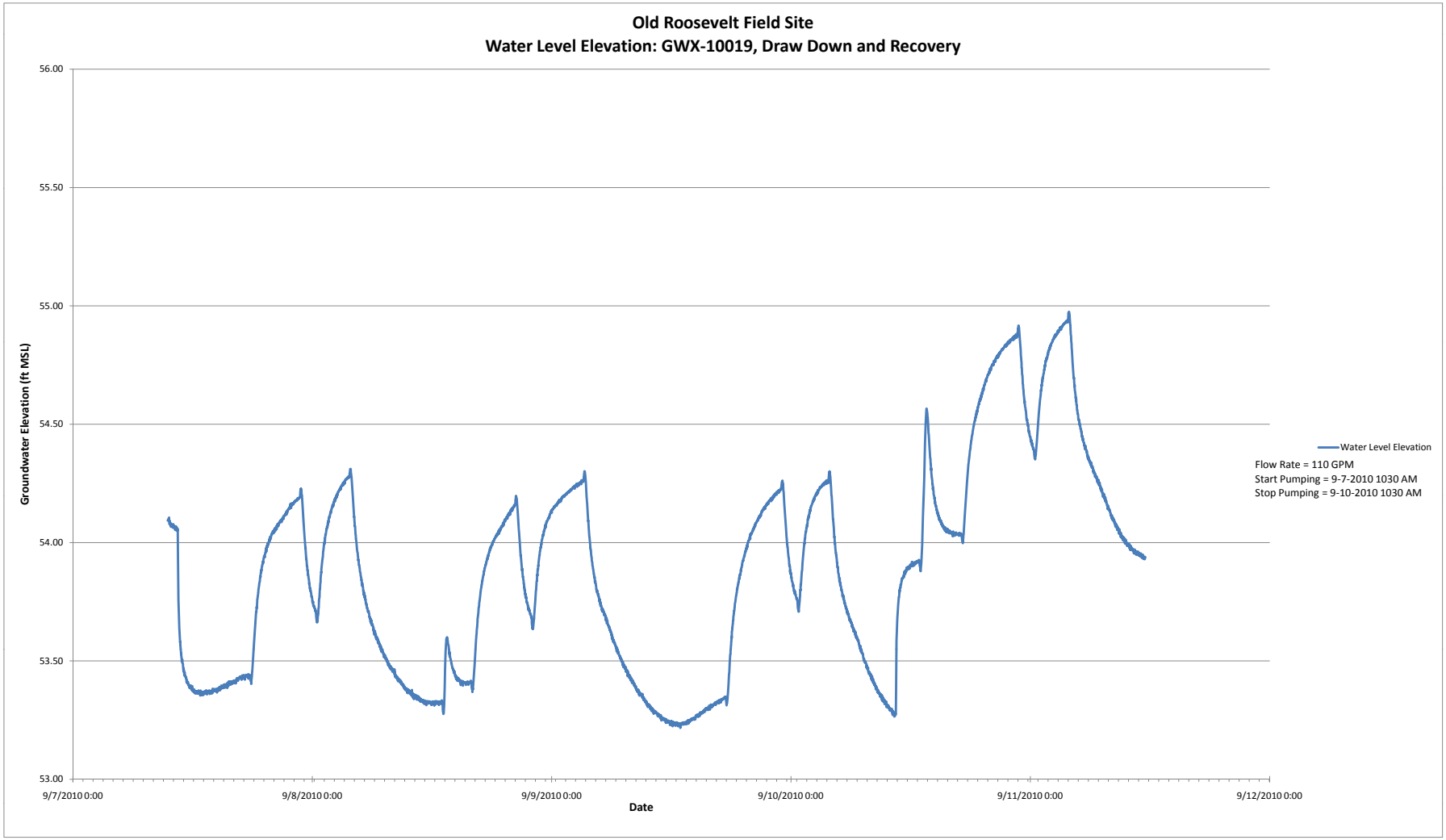

Old Roosevelt Field Site
Water Level Elevation: EW-1I, Draw Down and Recovery
52.00
51.00
50.00
49.00
48.00
47.00
46.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

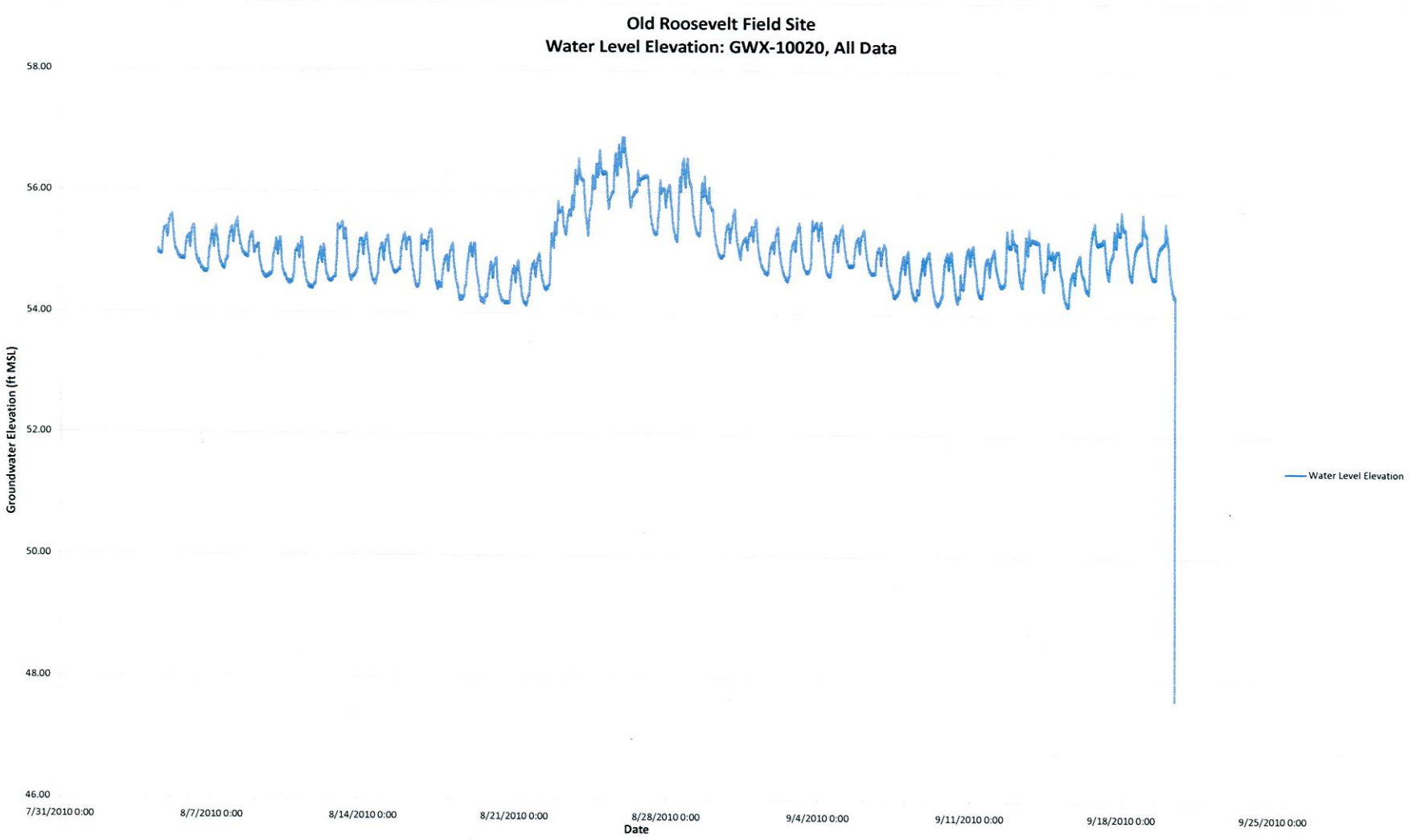

Old Roosevelt Field Site
Water Level Elevation: EW-1D, All Data
60.00
58.00
56.00
54.00
52.00
50.00
48.00
46.00
44.00
42.00
40.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation

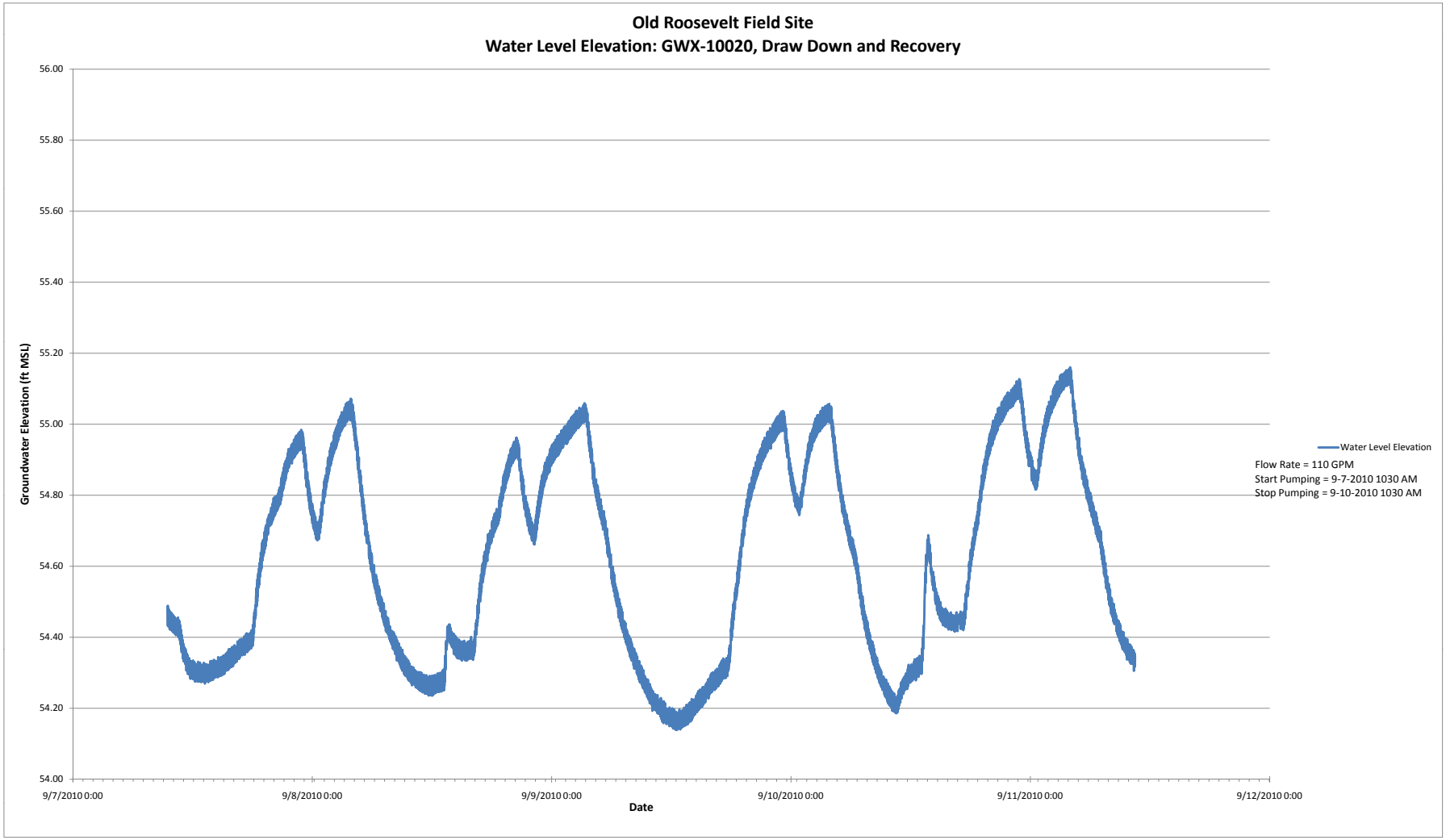

Old Roosevelt Field Site
Water Level Elevation: EW-1D, Step Test
Groundwater Elevation (ft MSL)
52.00
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
43.00
42.00
9/2/2010 4:59
9/2/2010 6:00
9/2/2010 7:00
9/2/2010 8:00
9/2/2010 9:01
9/2/2010 10:01
9/2/2010 11:02
9/2/2010 12:02
9/2/2010 13:03
9/2/2010 14:03
9/2/2010 15:04
9/2/2010 16:04
9/2/2010 17:05
Date
Water Level Elevation
Flow Rates
Step 1 = 60 GPM
Step 2 = 100 GPM
Step 3 = 140 GPM
Step 4 = 180 GPM

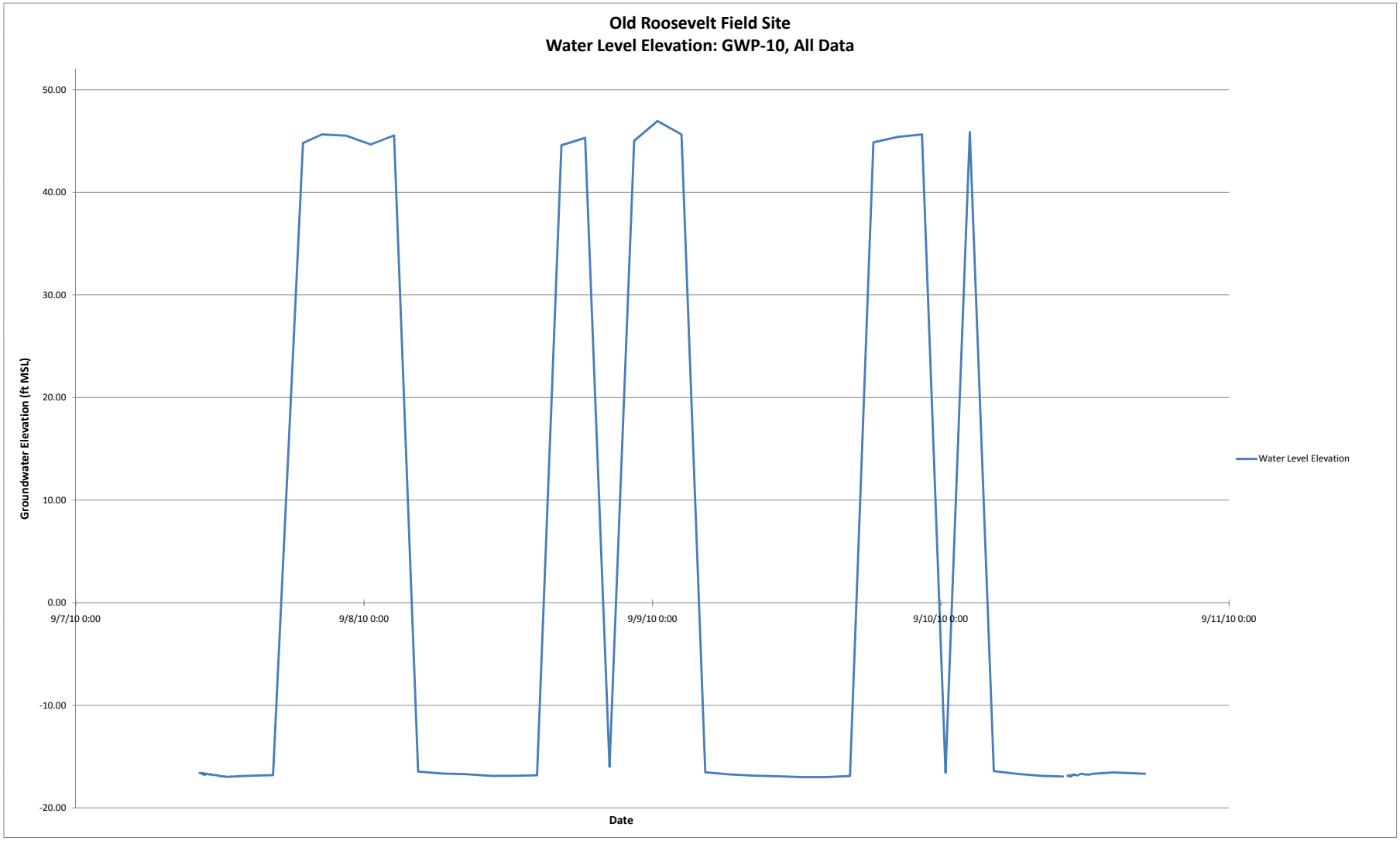

Old Roosevelt Field Site
Water Level Elevation: EW-1D, Draw Down and Recovery
52.00
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

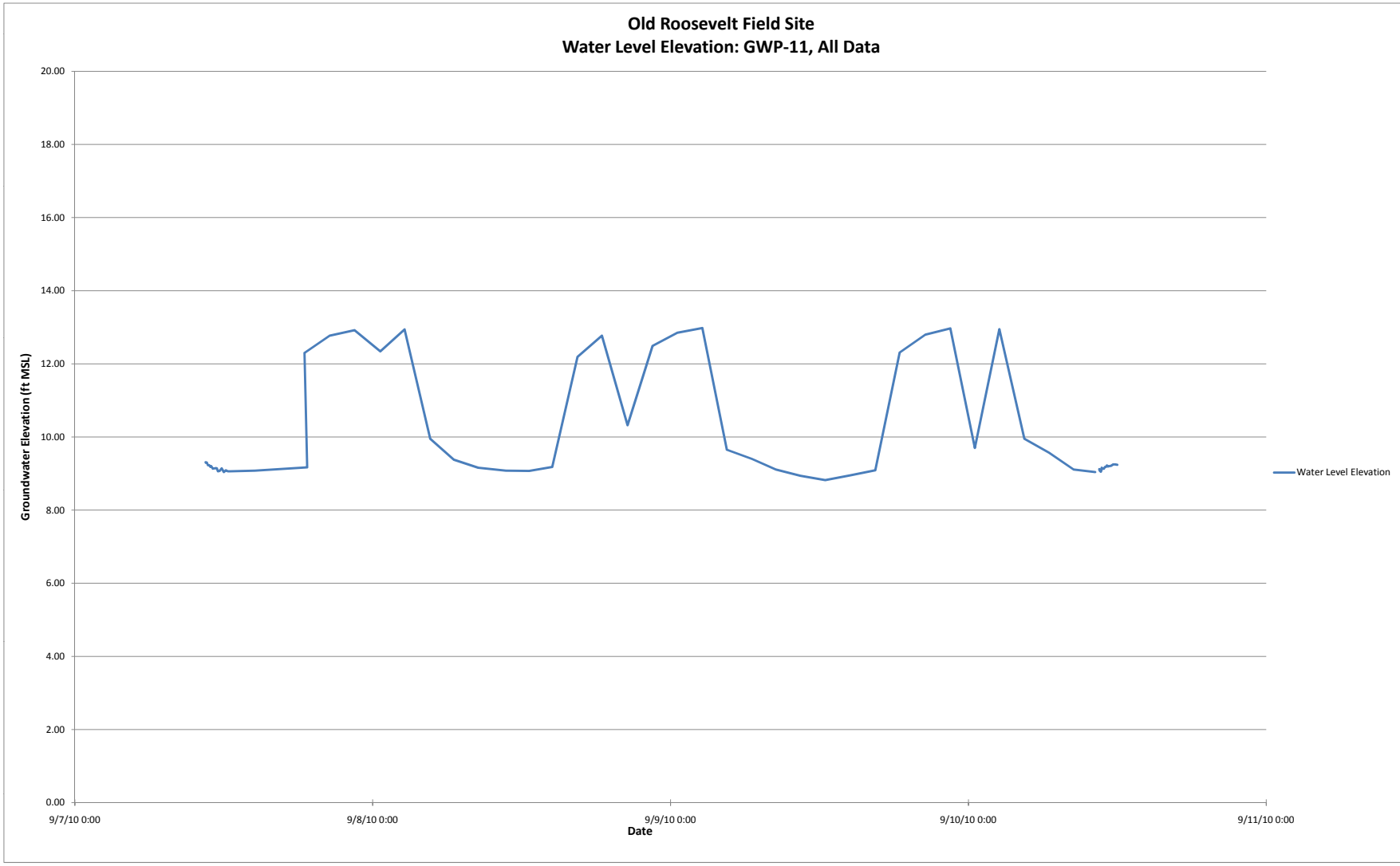

Old Roosevelt Field Site
Water Level Elevation: GWX-10019, All Data
Groundwater Elevation (ft MSL)
58.00
57.00
56.00
55.00
54.00
53.00
52.00
51.00
50.00
49.00
48.00
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

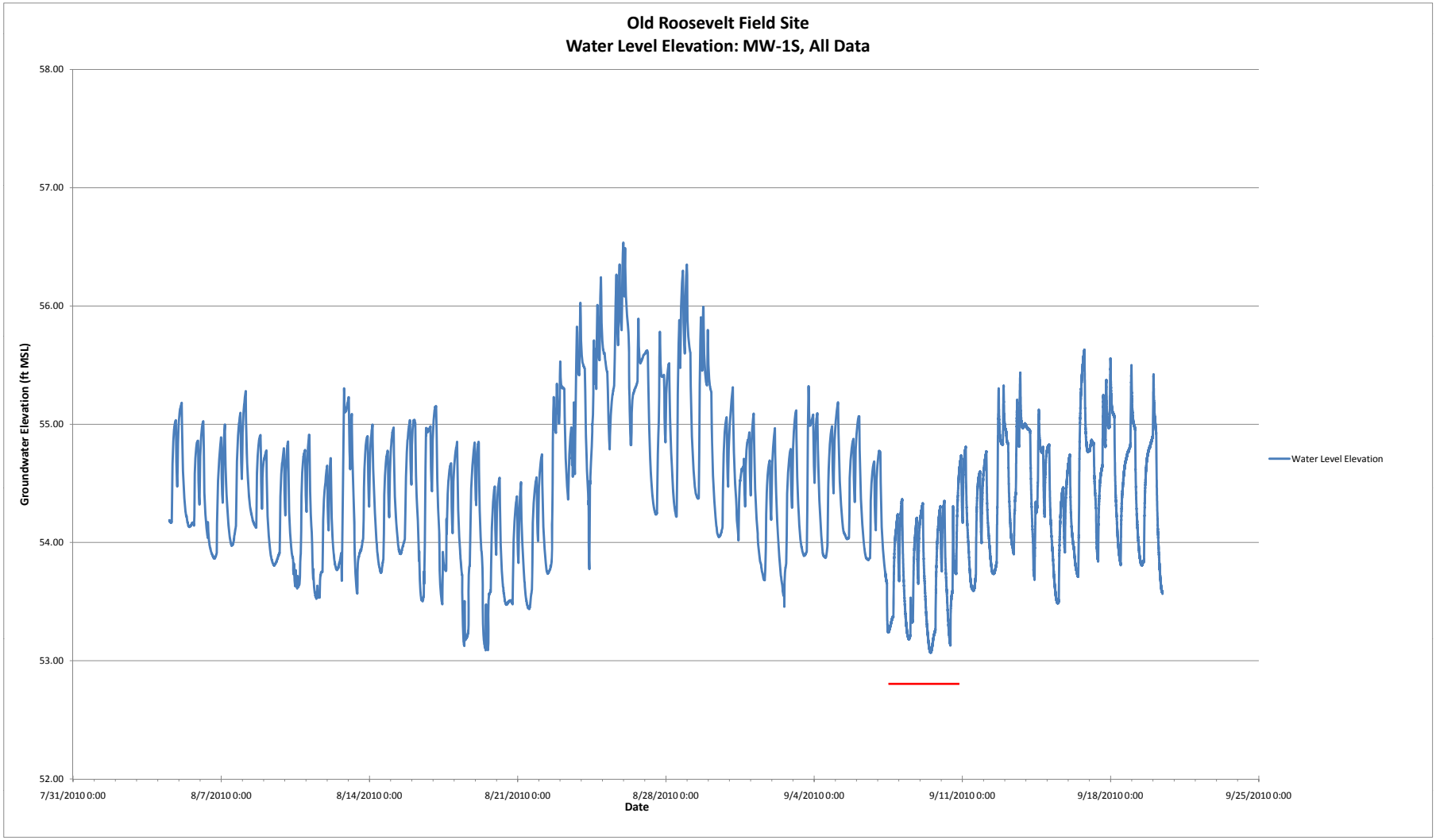

Old Roosevelt Field Site
Water Level Elevation: GWX-10019, Draw Down and Recovery
56.00
55.50
55.00
54.50
54.00
53.50
53.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

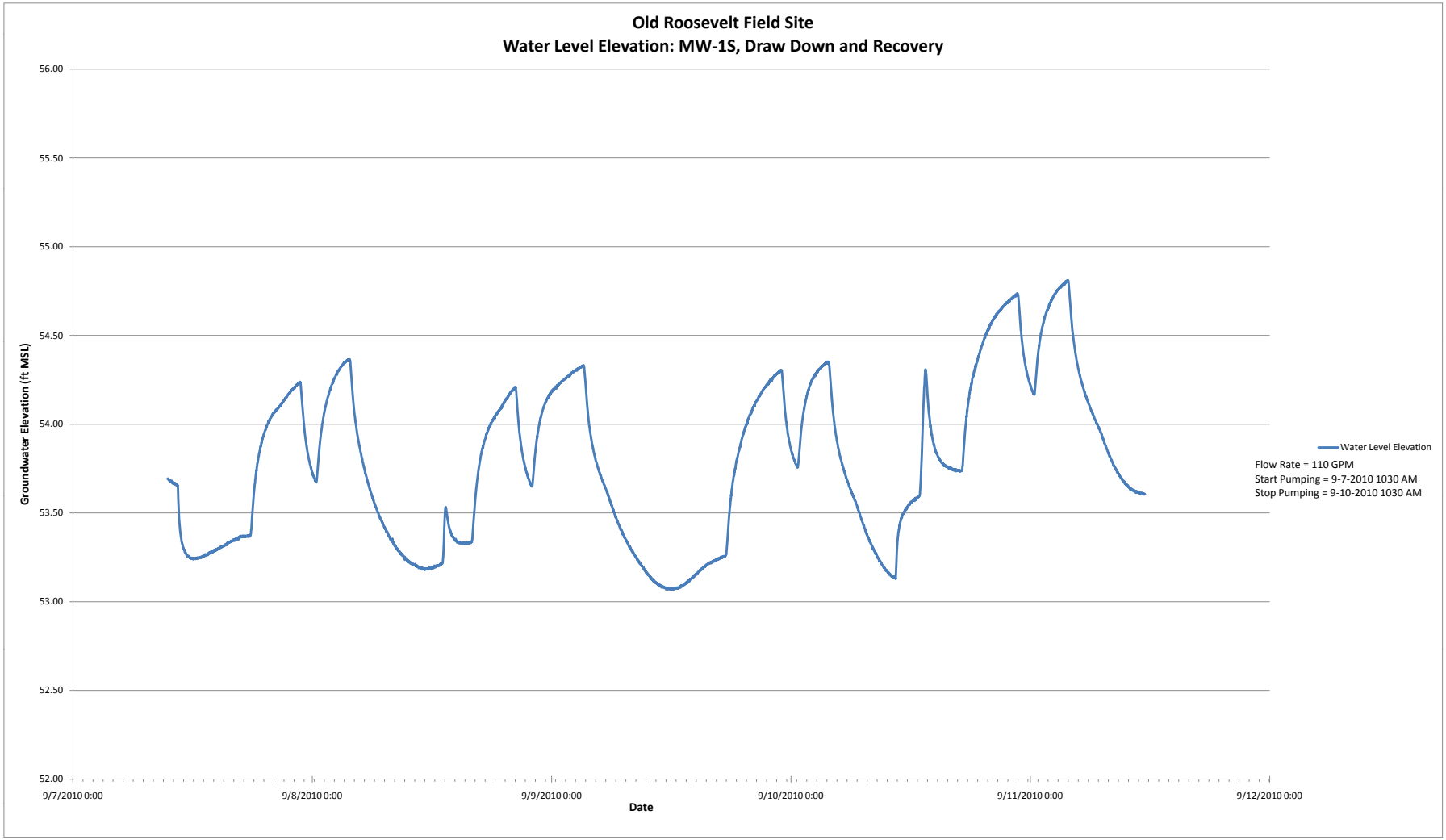

Old Roosevelt Field Site
Water Level Elevation: GWX-10020, All Data
58.00
56.00
54.00
52.00
50.00
48.00
46.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

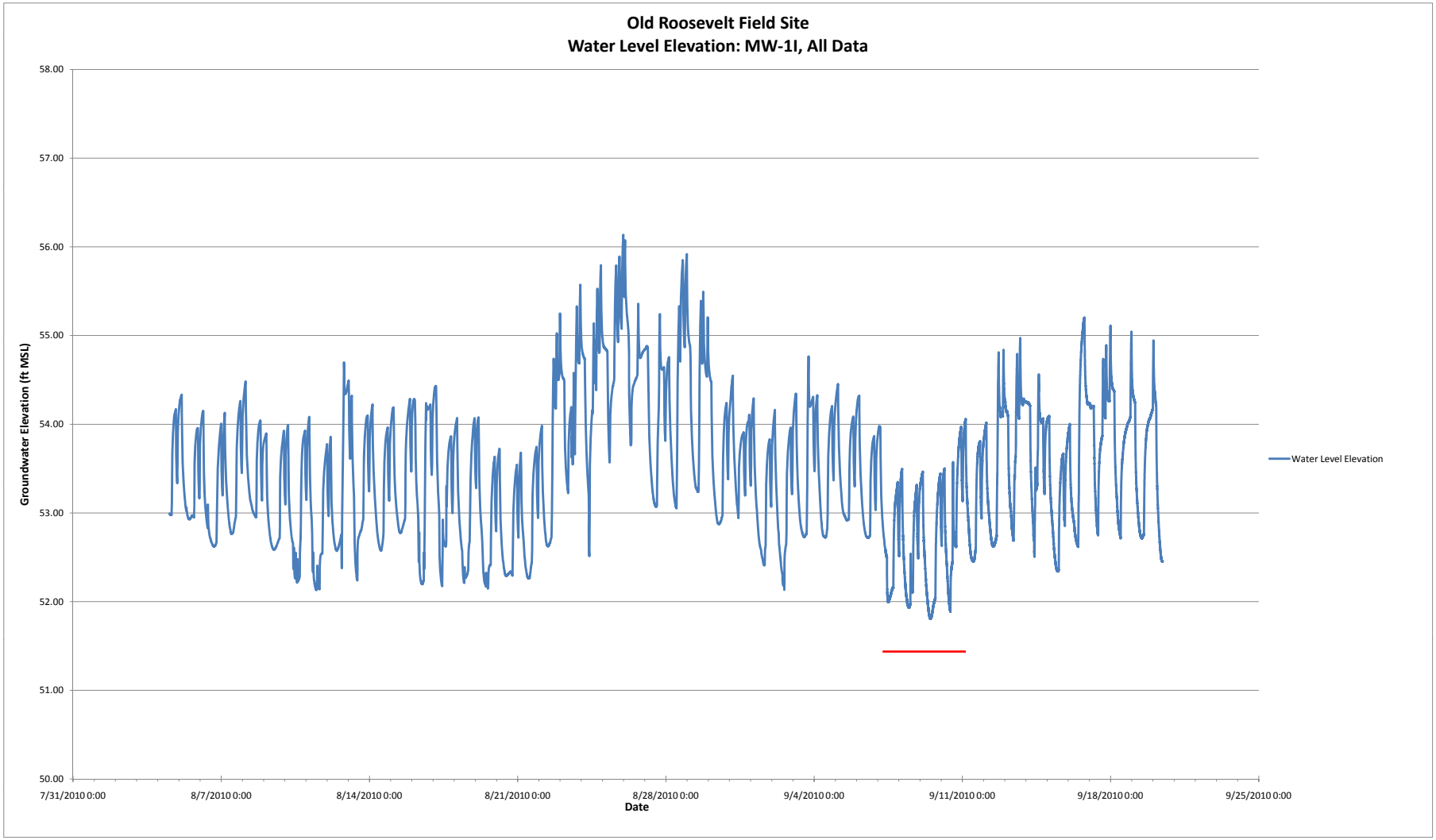

Old Roosevelt Field Site
Water Level Elevation: GWX-10020, Draw Down and Recovery
Groundwater Elevation (ft MSL)
56.00
55.80
55.60
55.40
55.20
55.00
54.80
54.60
54.40
54.20
54.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

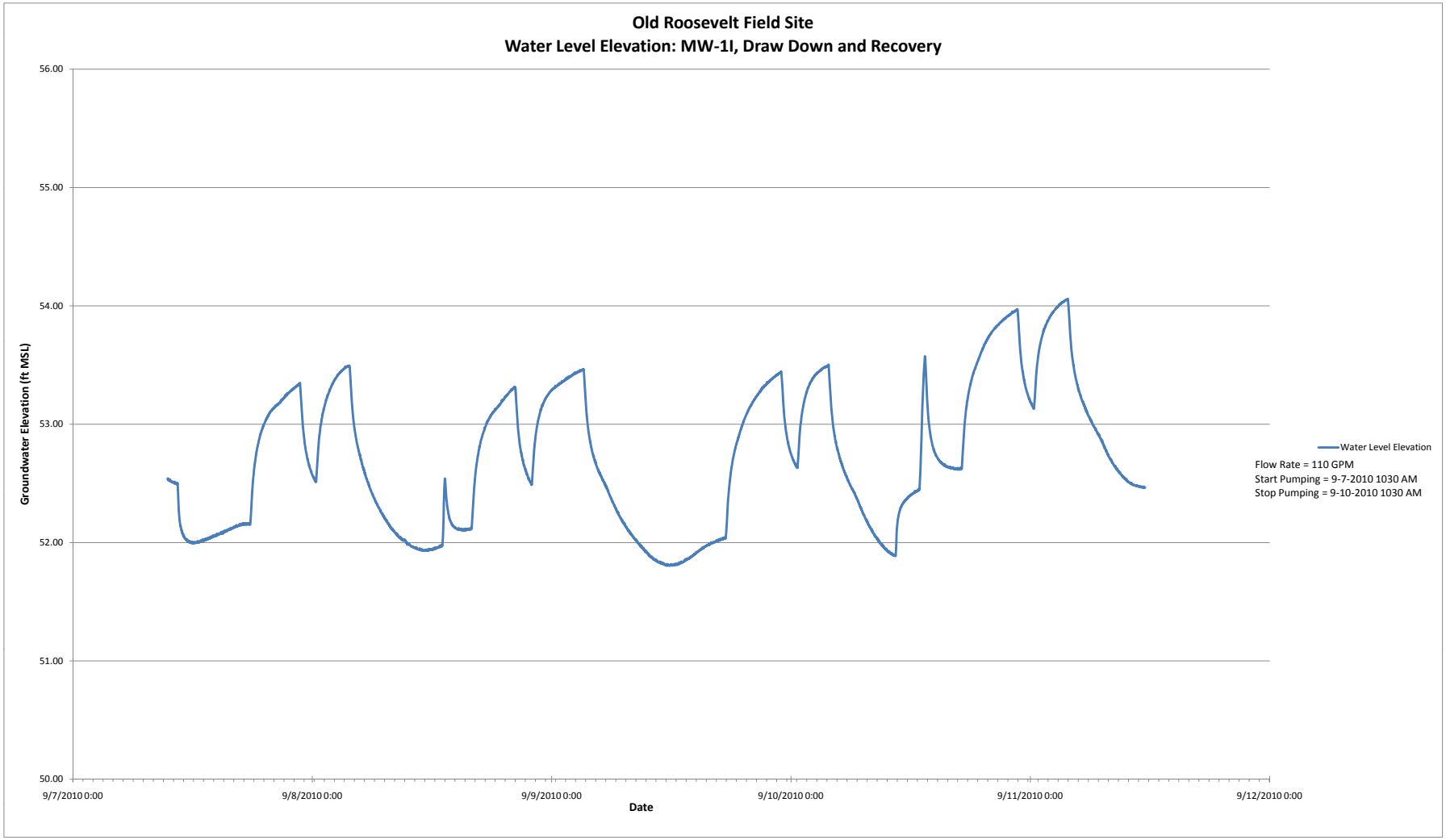

Old Roosevelt Field Site
Water Level Elevation: GWP-10, All Data
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
Groundwater Elevation (ft MSL)
9/7/10 0:00
9/8/10 0:00
9/9/10 0:00
9/10/10 0:00
9/11/10 0:00
Date
Water Level Elevation

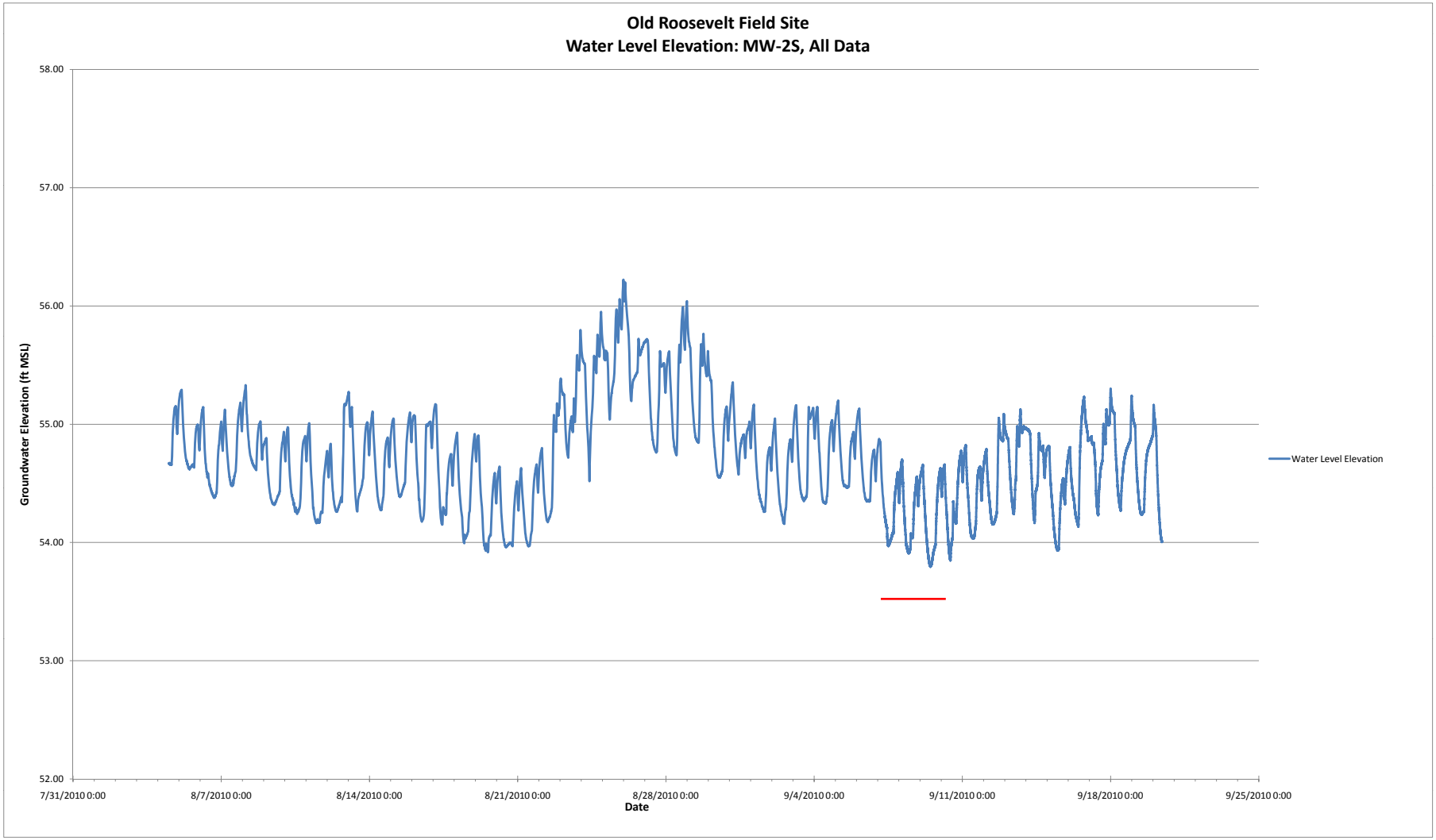

Old Roosevelt Field Site
Water Level Elevation: GWP-11, All Data
Groundwater Elevation (ft MSL)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
9/7/10 0:00
9/8/10 0:00
9/9/10 0:00
9/10/10 0:00
9/11/10 0:00
Date
Water Level Elevation

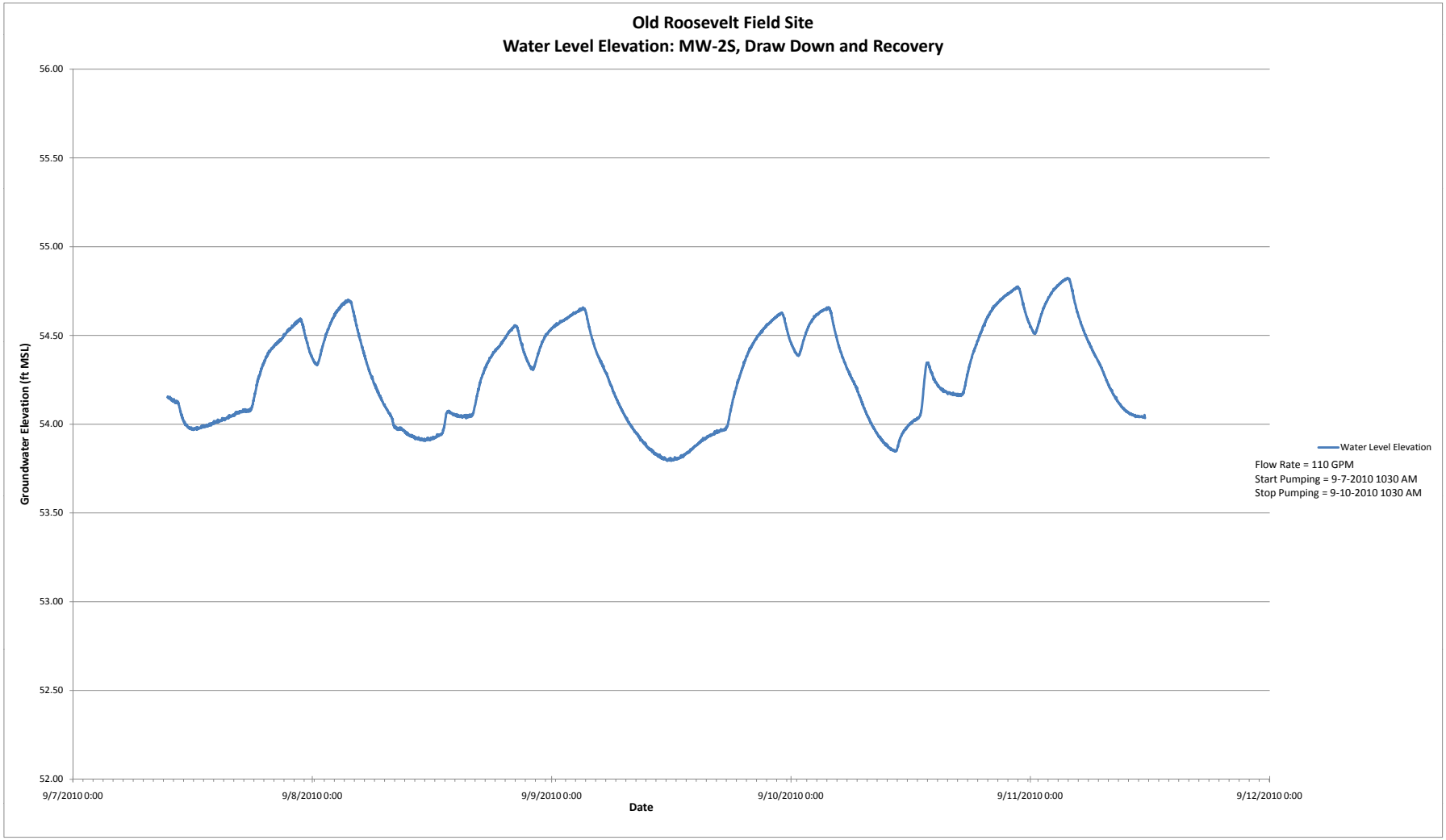

Old Roosevelt Field Site
Water Level Elevation: MW-1S, All Data
58.00
57.00
56.00
55.00
54.00
53.00
52.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

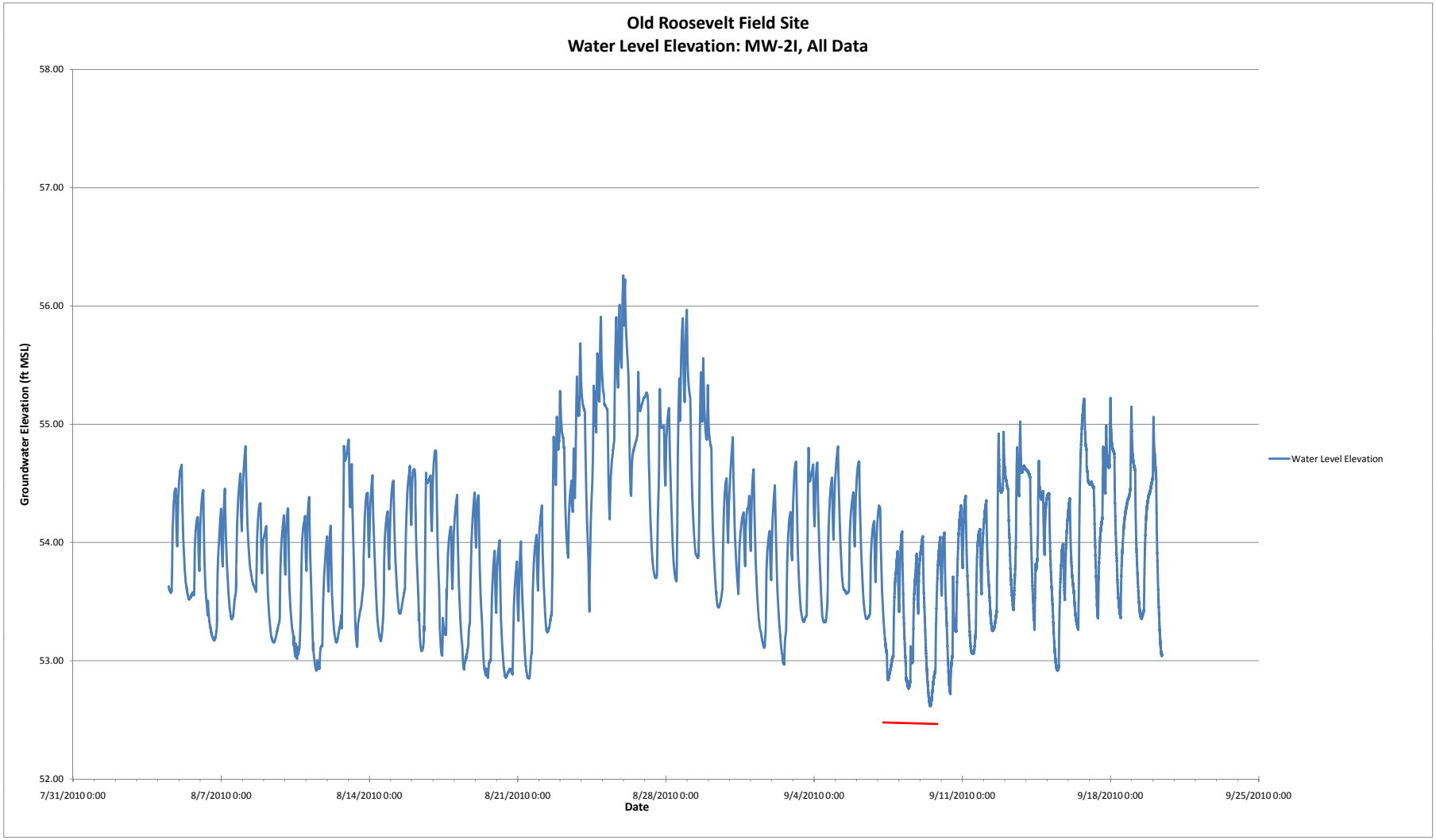

Old Roosevelt Field Site
Water Level Elevation: MW-1S, Draw Down and Recovery
Groundwater Elevation (ft MSL)
56.00
55.50
55.00
54.50
54.00
53.50
53.00
52.50
52.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

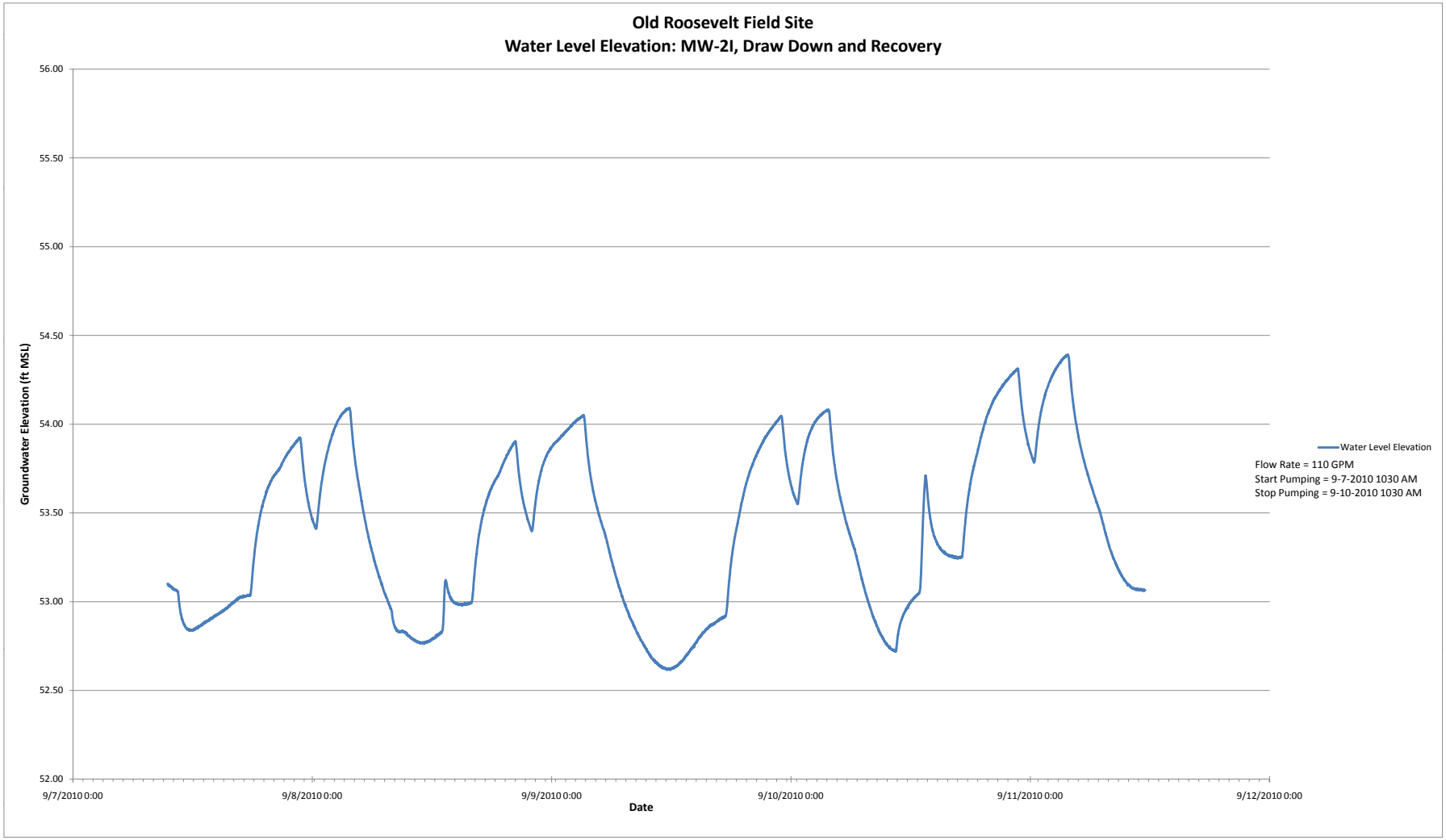

Old Roosevelt Field Site
Water Level Elevation: MW-1I, All Data
Groundwater Elevation (ft MSL)
58.00
57.00
56.00
55.00
54.00
53.00
52.00
51.00
50.00
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

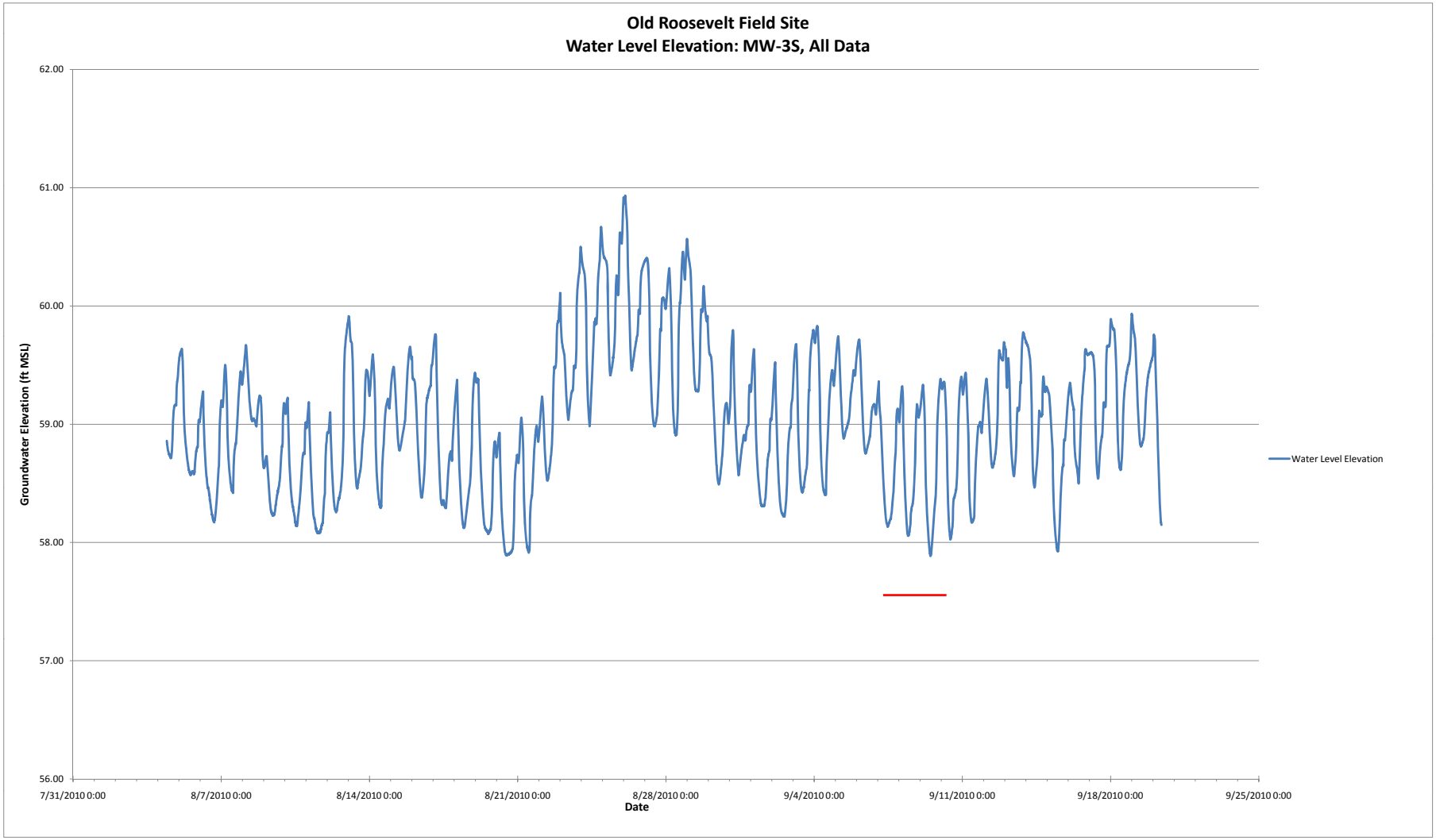

Old Roosevelt Field Site
Water Level Elevation: MW-1I, Draw Down and Recovery
56.00
55.00
54.00
53.00
52.00
51.00
50.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

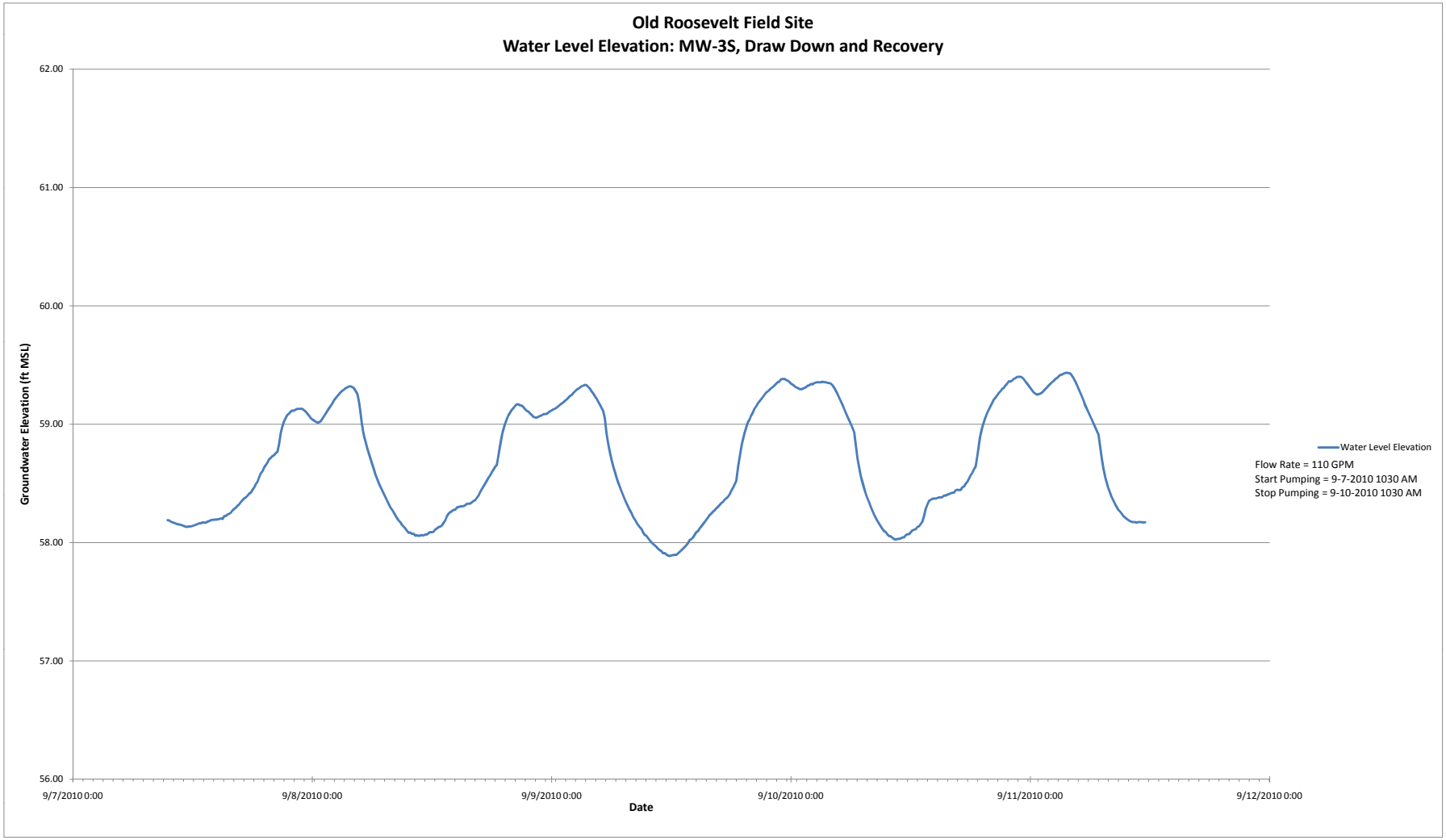

Old Roosevelt Field Site
Water Level Elevation: MW-2S, All Data
58.00
57.00
56.00
55.00
54.00
53.00
52.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

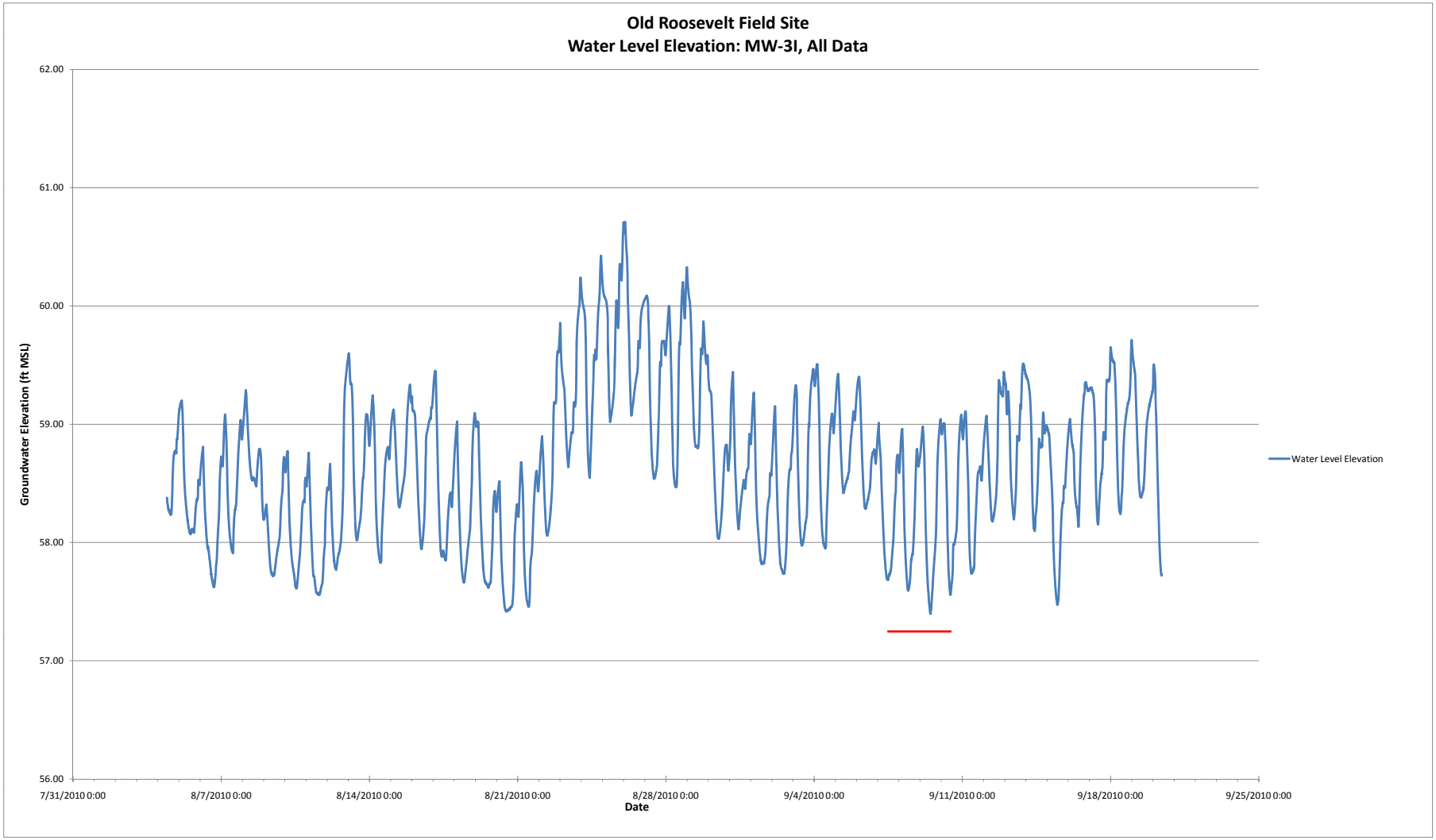

Old Roosevelt Field Site
Water Level Elevation: MW-2S, Draw Down and Recovery
56.00
55.50
55.00
54.50
54.00
53.50
53.00
52.50
52.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

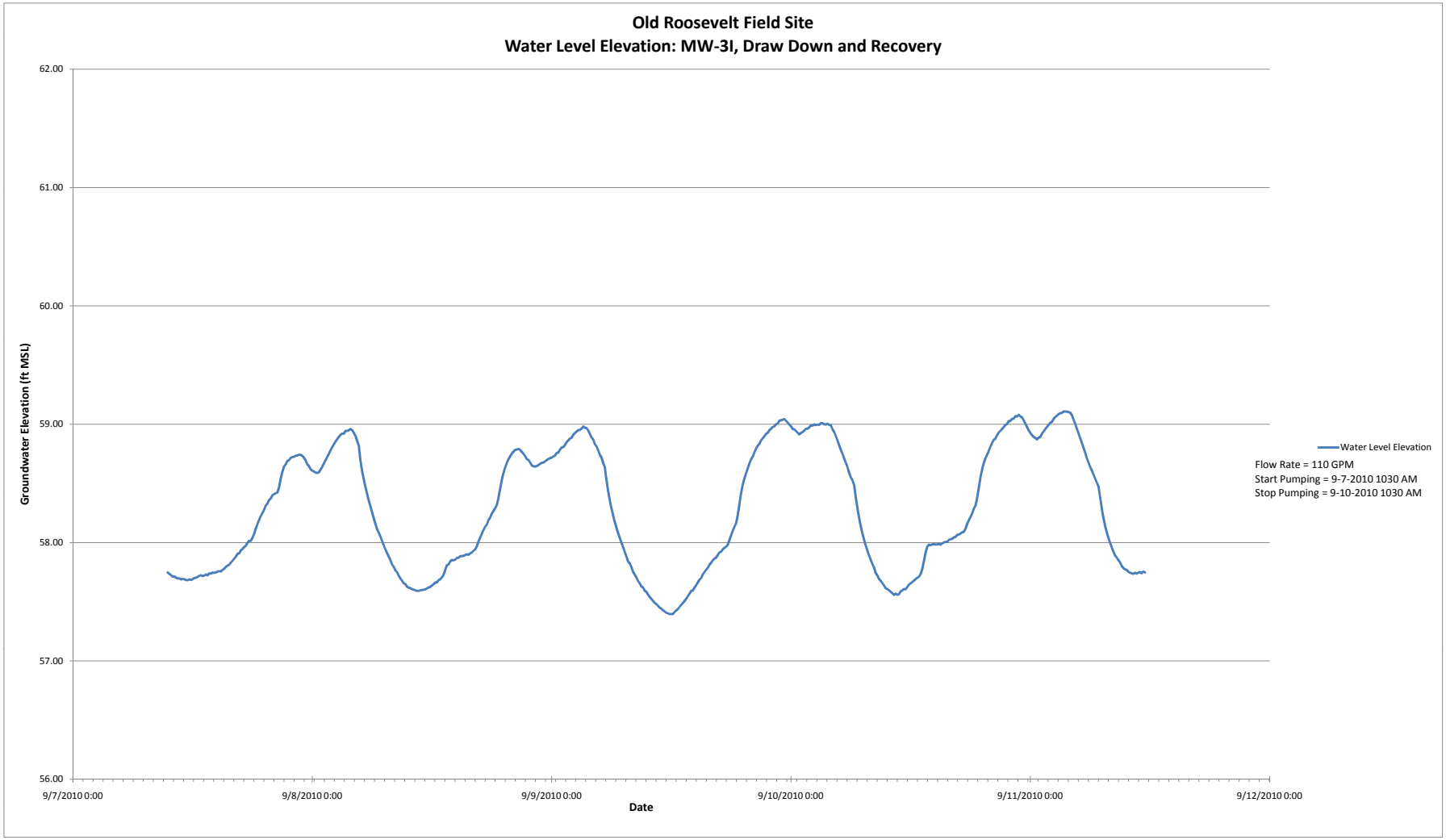

Old Roosevelt Field Site
Water Level Elevation: MW-2I, All Data
58.00
57.00
56.00
55.00
54.00
53.00
52.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

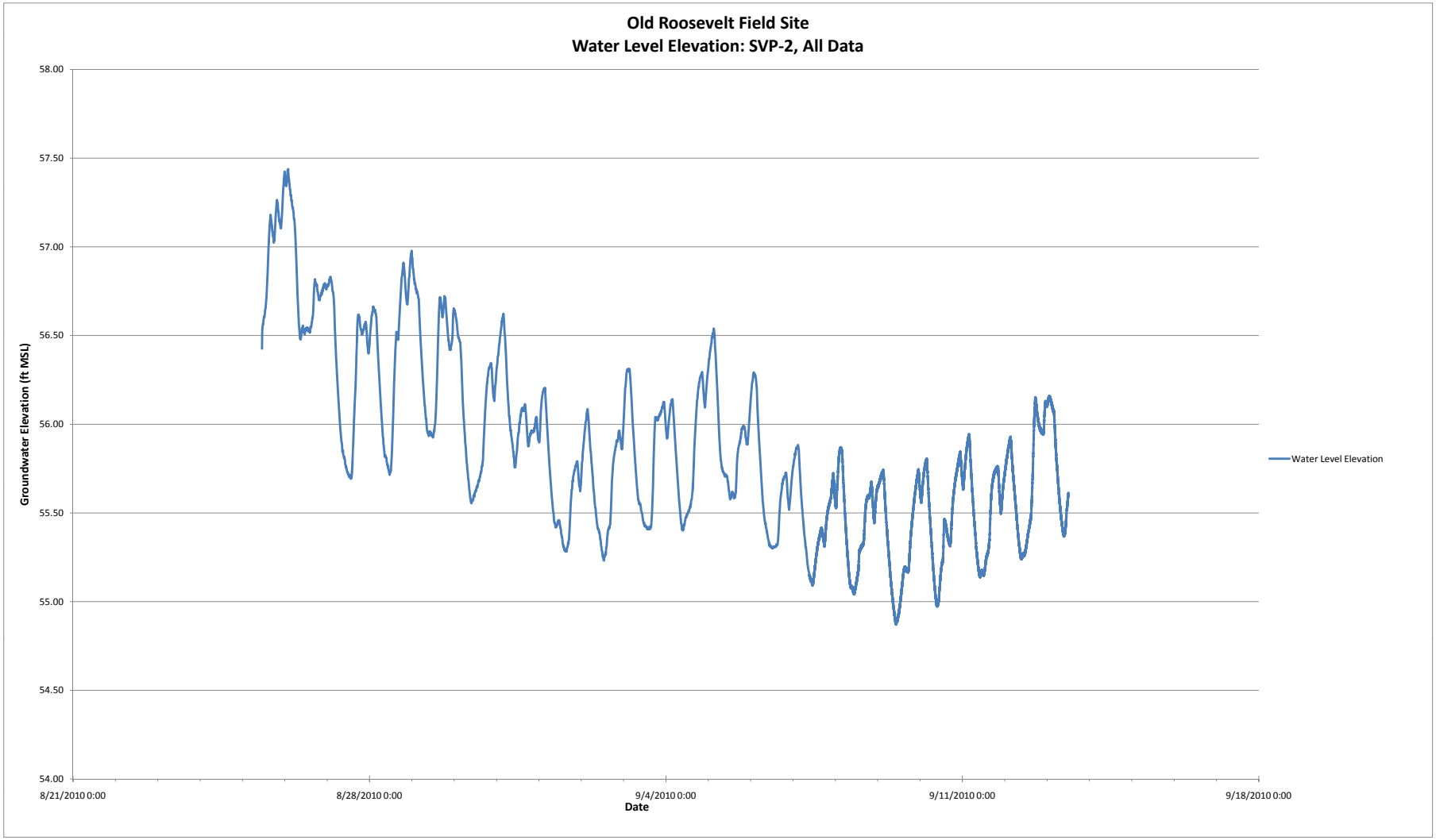

Old Roosevelt Field Site
Water Level Elevation: MW-2I, Draw Down and Recovery
Groundwater Elevation (ft MSL)
56.00
55.50
55.00
54.50
54.00
53.50
53.00
52.50
52.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

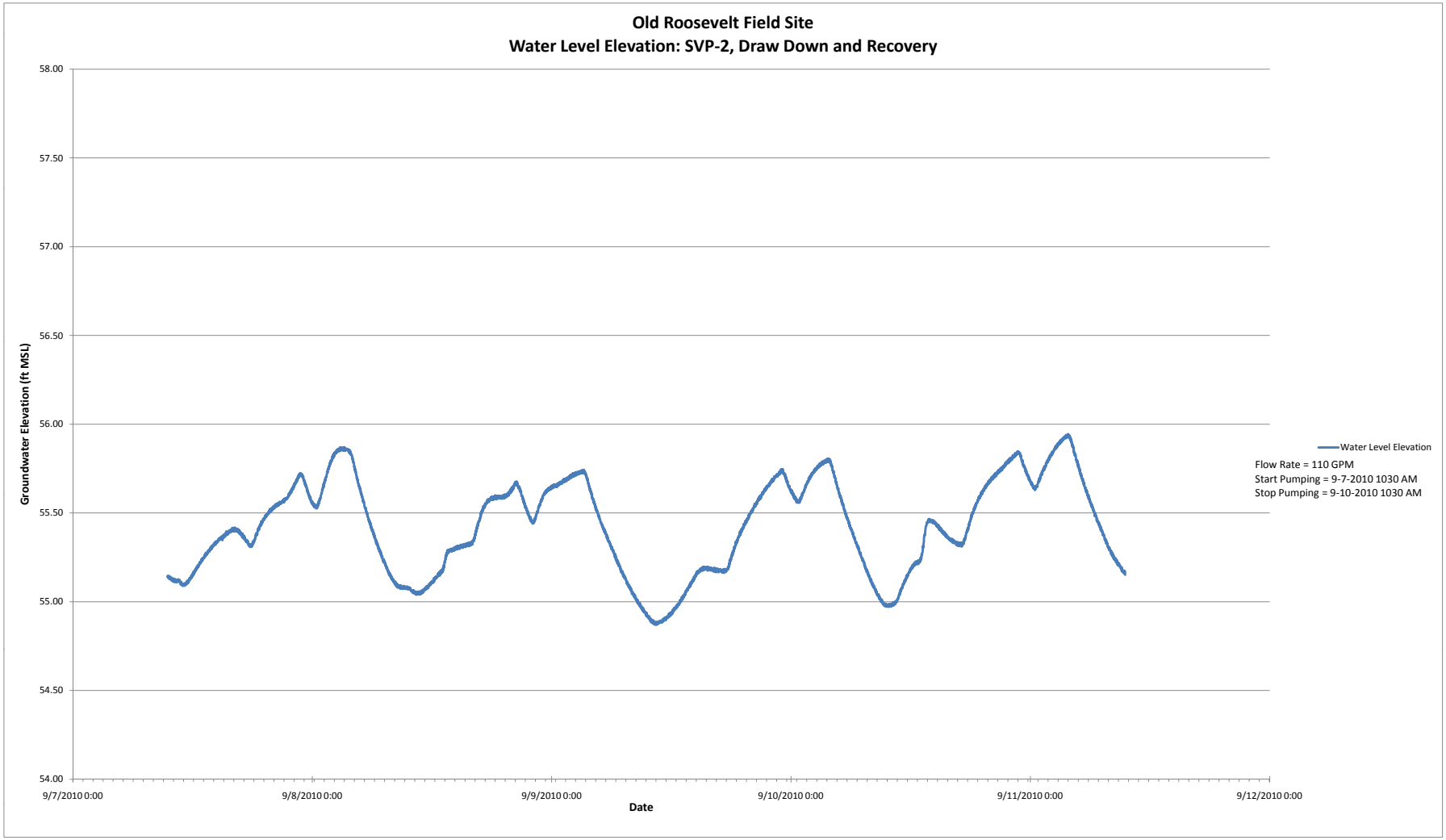

Old Roosevelt Field Site
Water Level Elevation: MW-3S, All Data
62.00
61.00
60.00
59.00
58.00
57.00
56.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

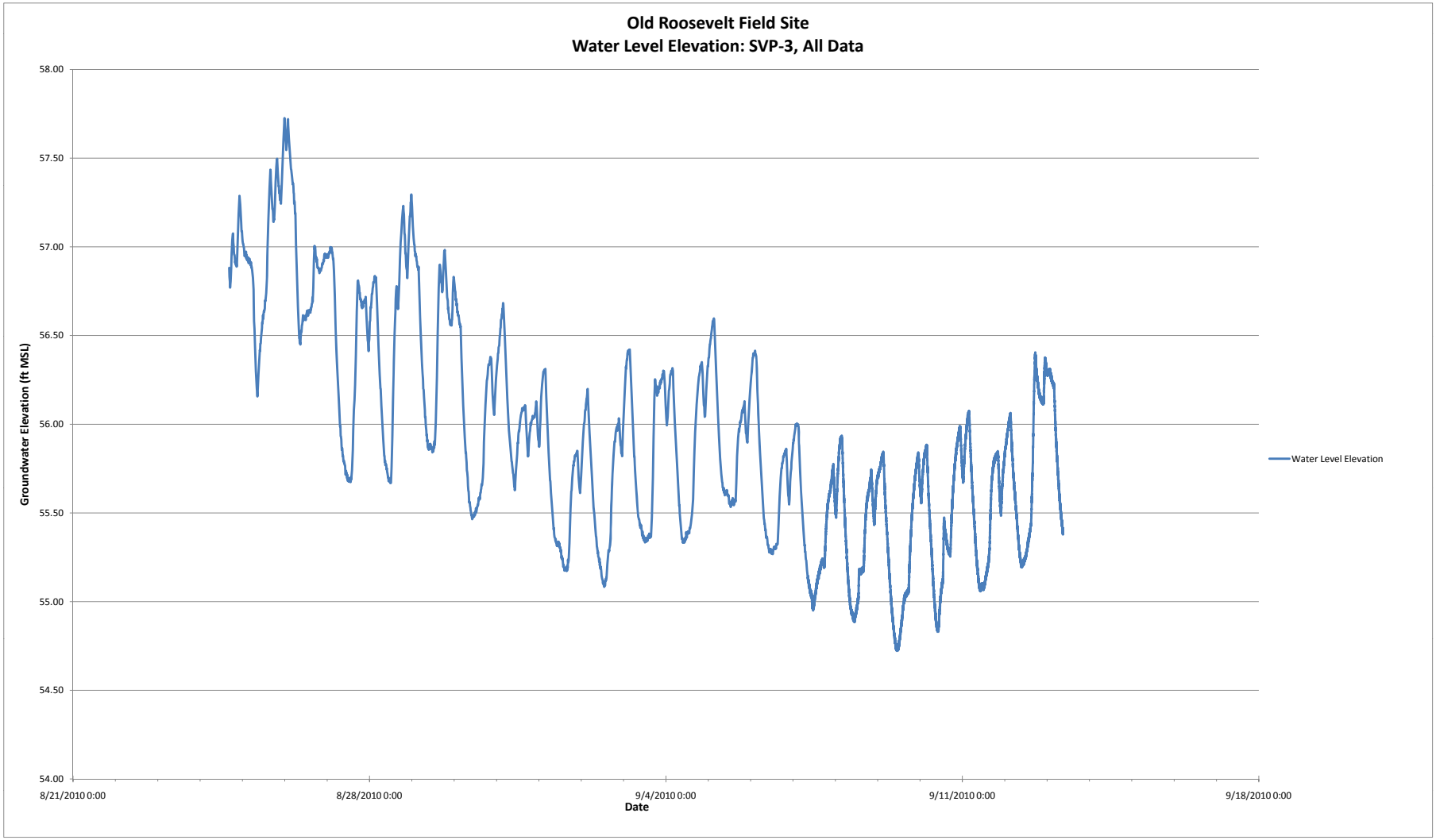

Old Roosevelt Field Site
Water Level Elevation: MW-3S, Draw Down and Recovery
62.00
61.00
60.00
59.00
58.00
57.00
56.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

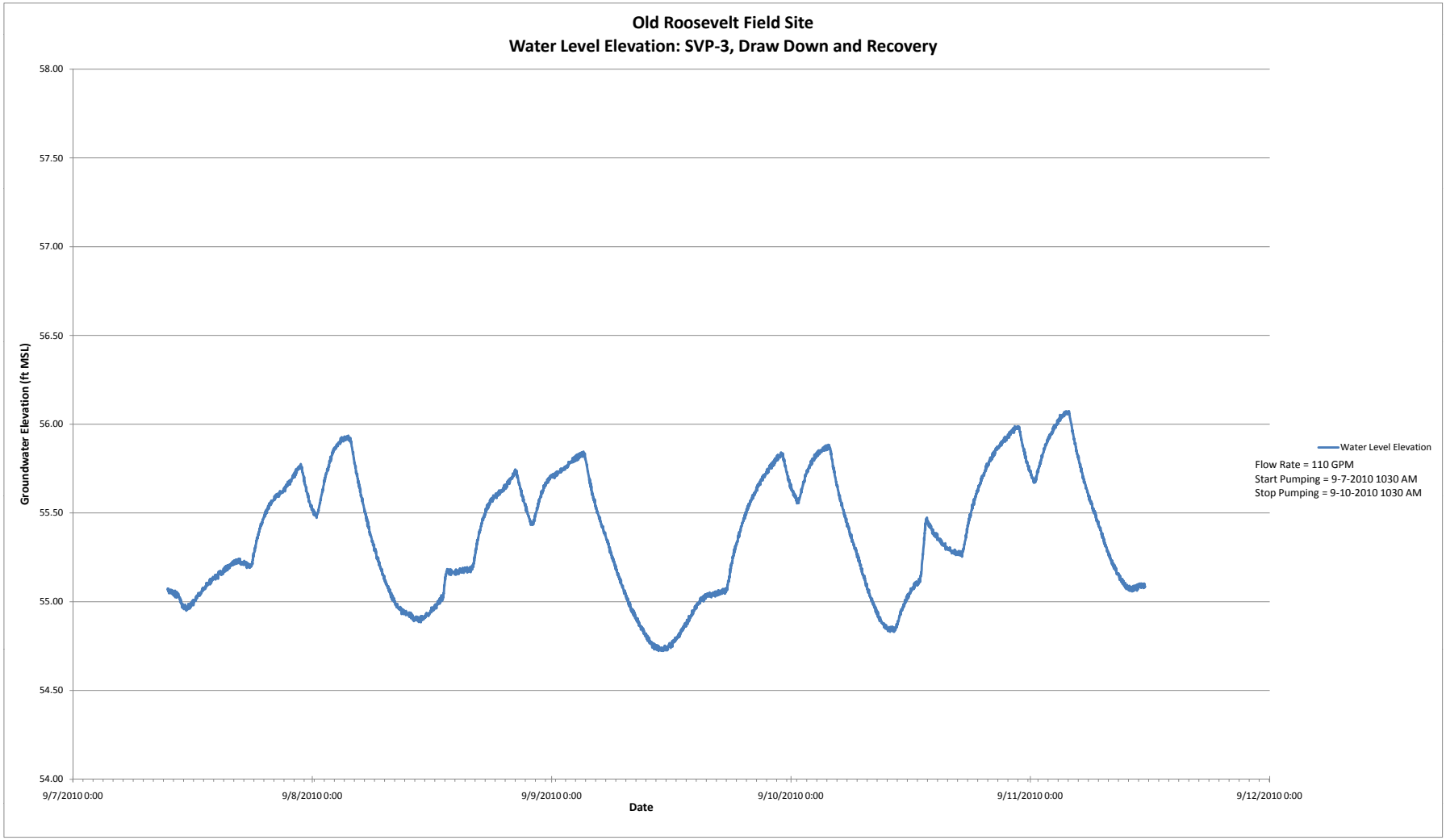

Old Roosevelt Field Site
Water Level Elevation: MW-3I, All Data
62.00
61.00
60.00
59.00
58.00
57.00
56.00
Groundwater Elevation (ft MSL)
7/31/2010 0:00
8/7/2010 0:00
8/14/2010 0:00
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
9/25/2010 0:00
Date
Water Level Elevation

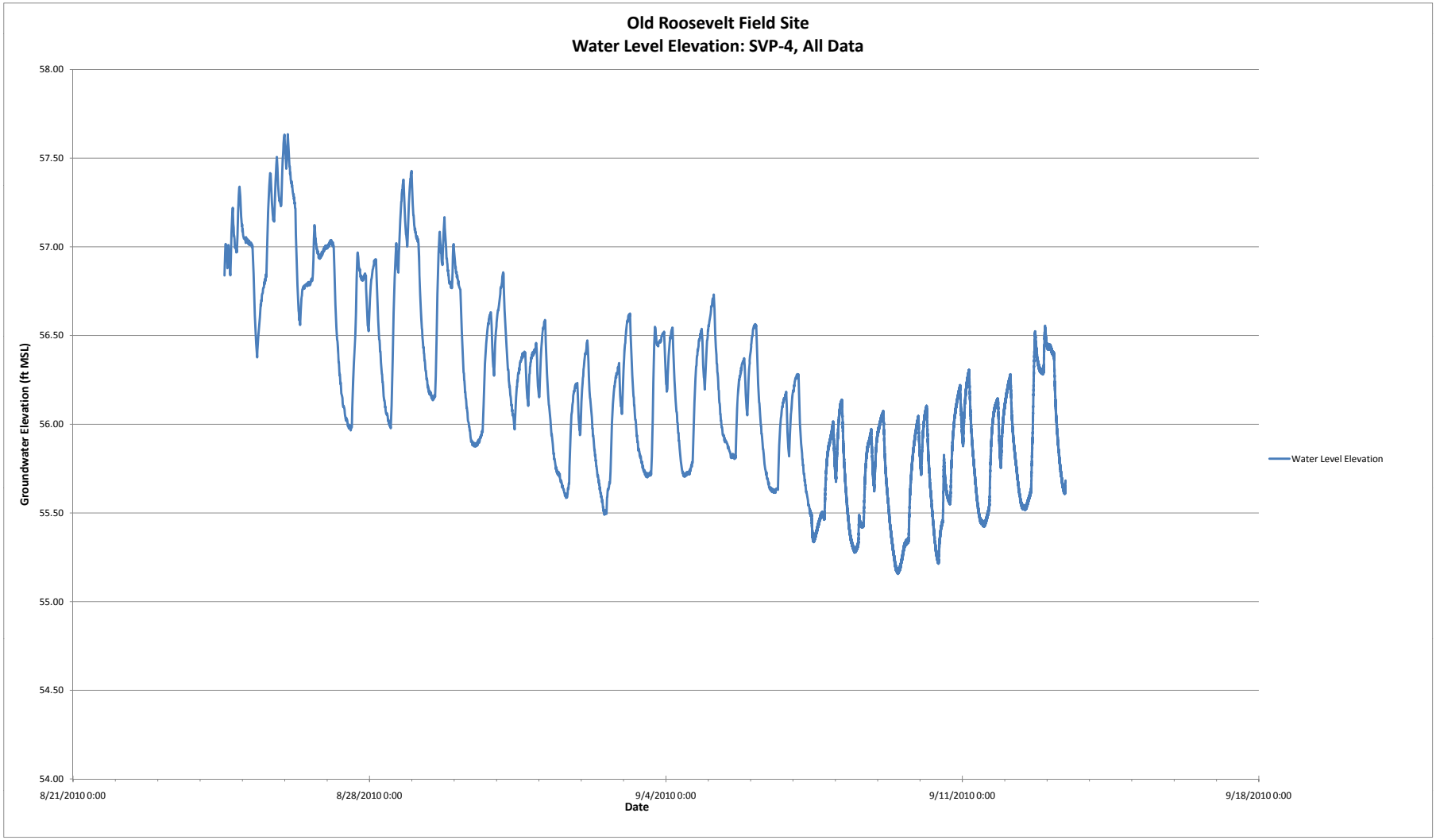

Old Roosevelt Field Site
Water Level Elevation: MW-3I, Draw Down and Recovery
62.00
61.00
60.00
59.00
58.00
57.00
56.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

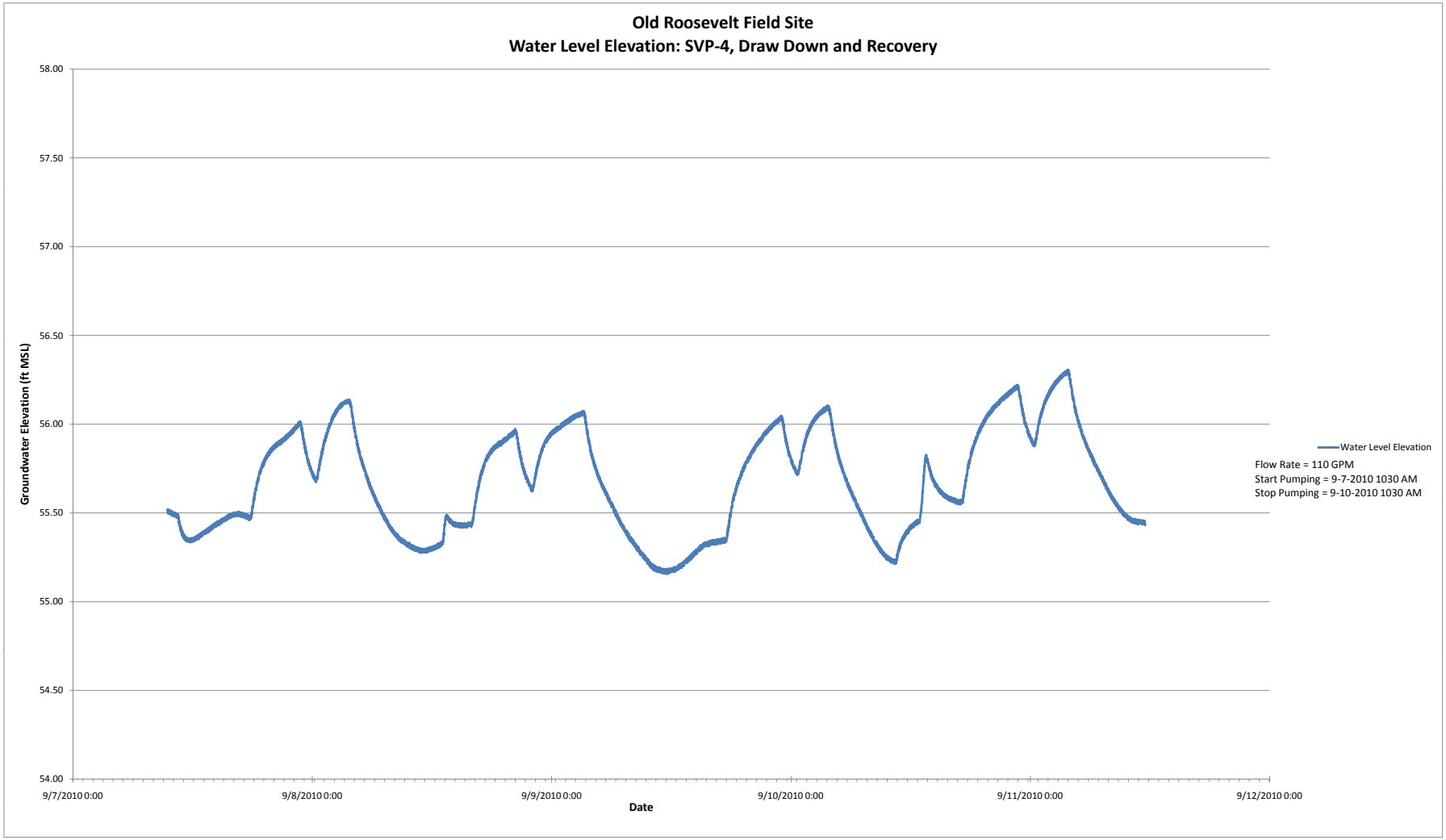

Old Roosevelt Field Site
Water Level Elevation: SVP-2, All Data
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation


Old Roosevelt Field Site
Water Level Elevation: SVP-2, Draw Down and Recovery
Groundwater Elevation (ft MSL)
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

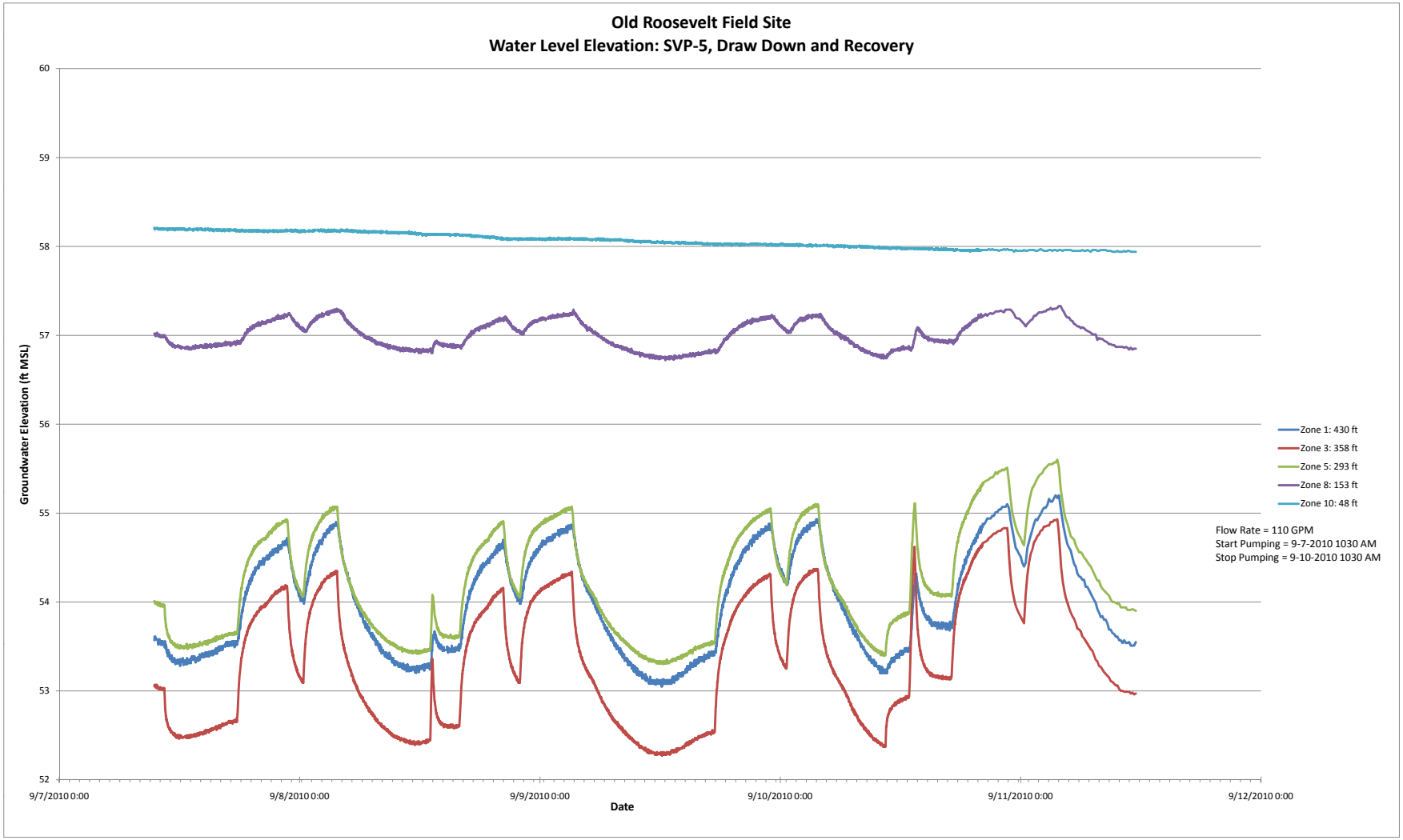

Old Roosevelt Field Site
Water Level Elevation: SVP-3, All Data
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation

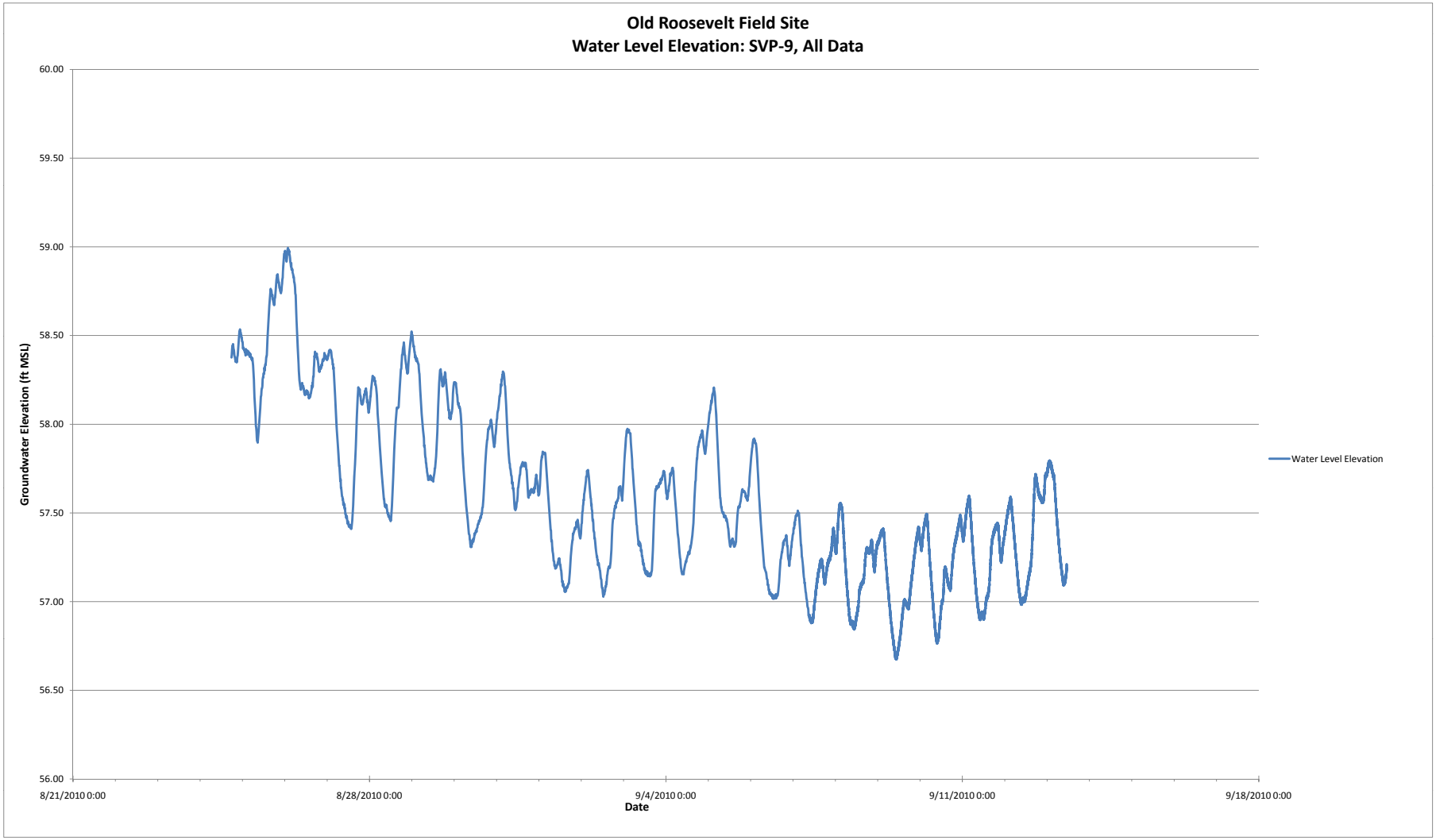

Old Roosevelt Field Site
Water Level Elevation: SVP-3, Draw Down and Recovery
Groundwater Elevation (ft MSL)
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

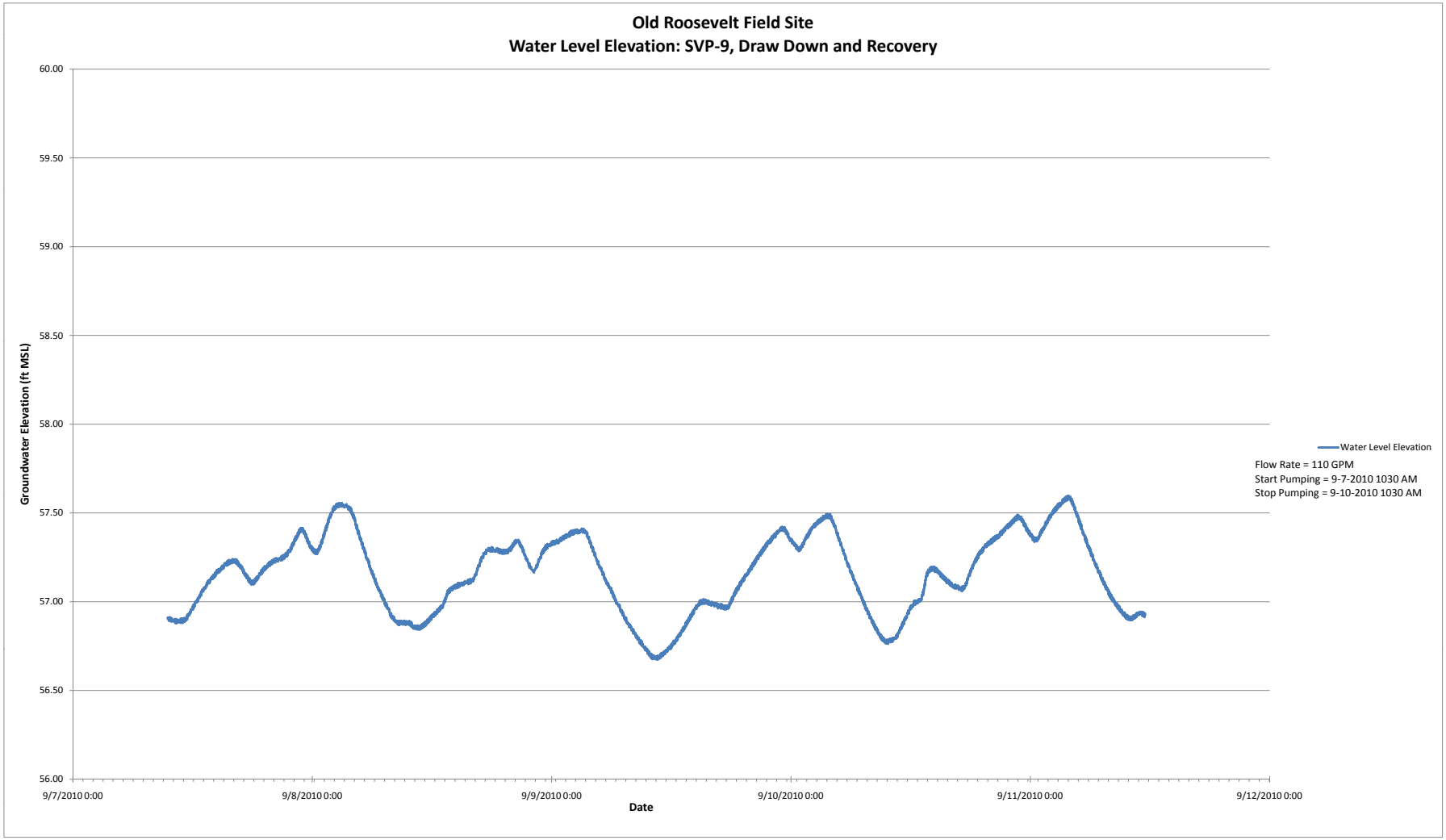

Old Roosevelt Field Site
Water Level Elevation: SVP-4, All Data
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation

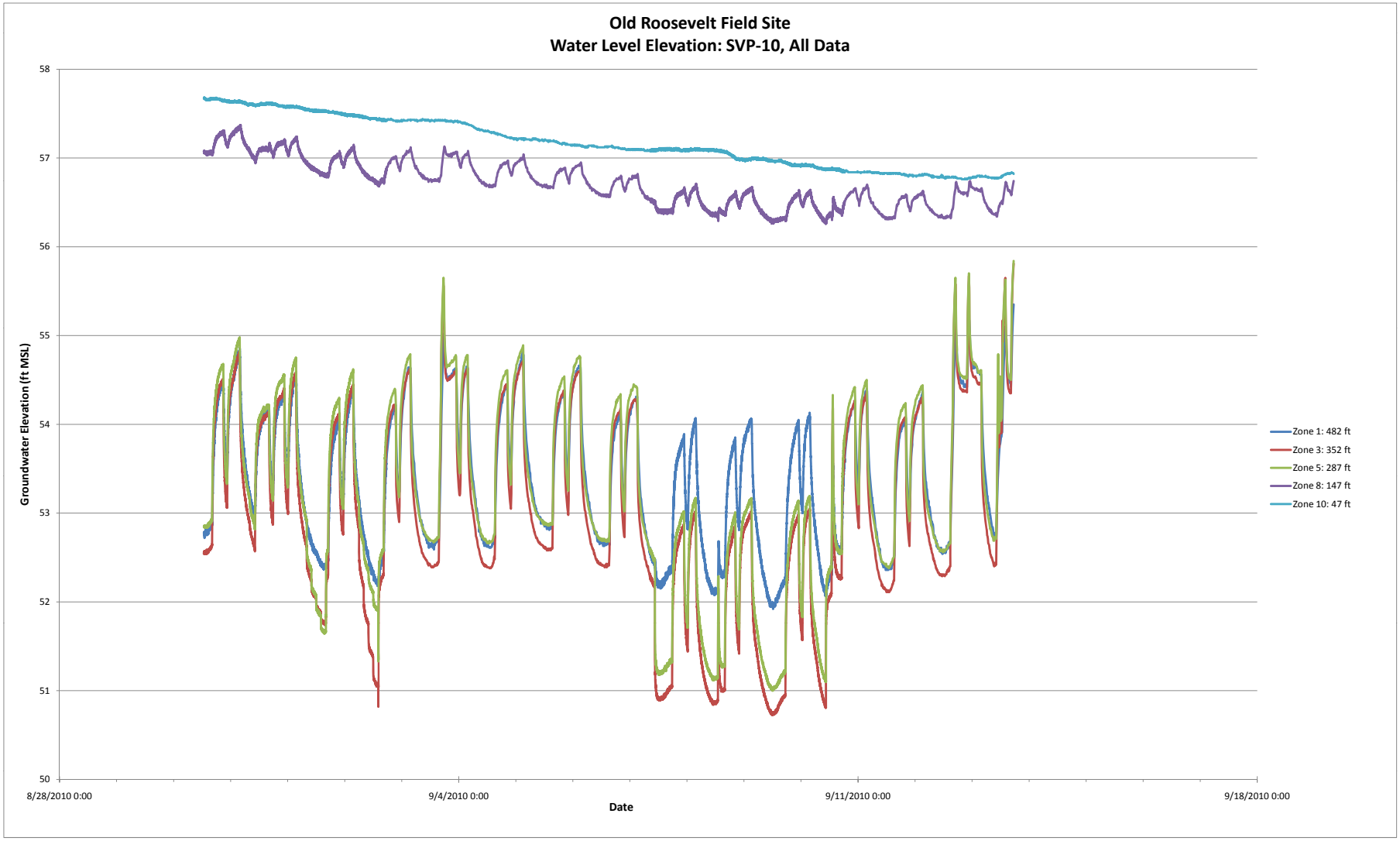

Old Roosevelt Field Site
Water Level Elevation: SVP-4, Draw Down and Recovery
58.00
57.50
57.00
56.50
56.00
55.50
55.00
54.50
54.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

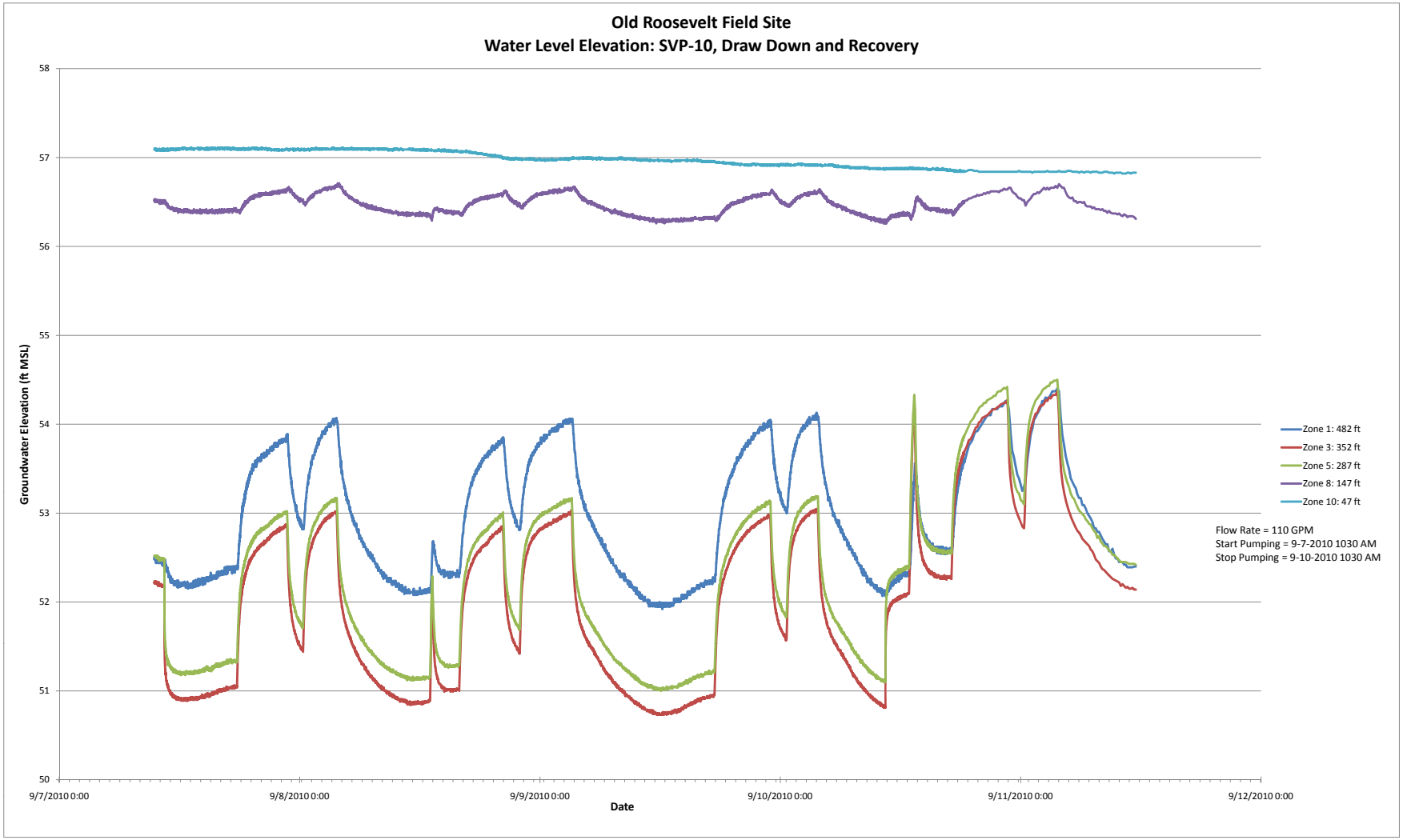

Old Roosevelt Field Site
Water Level Elevation: SVP-5, All Data
Groundwater Elevation (ft MSL)
60
59
58
57
56
55
54
53
52
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Zone 1: 430 ft
Zone 3: 358 ft
Zone 5: 293 ft
Zone 8: 153 ft
Zone 10: 48 ft

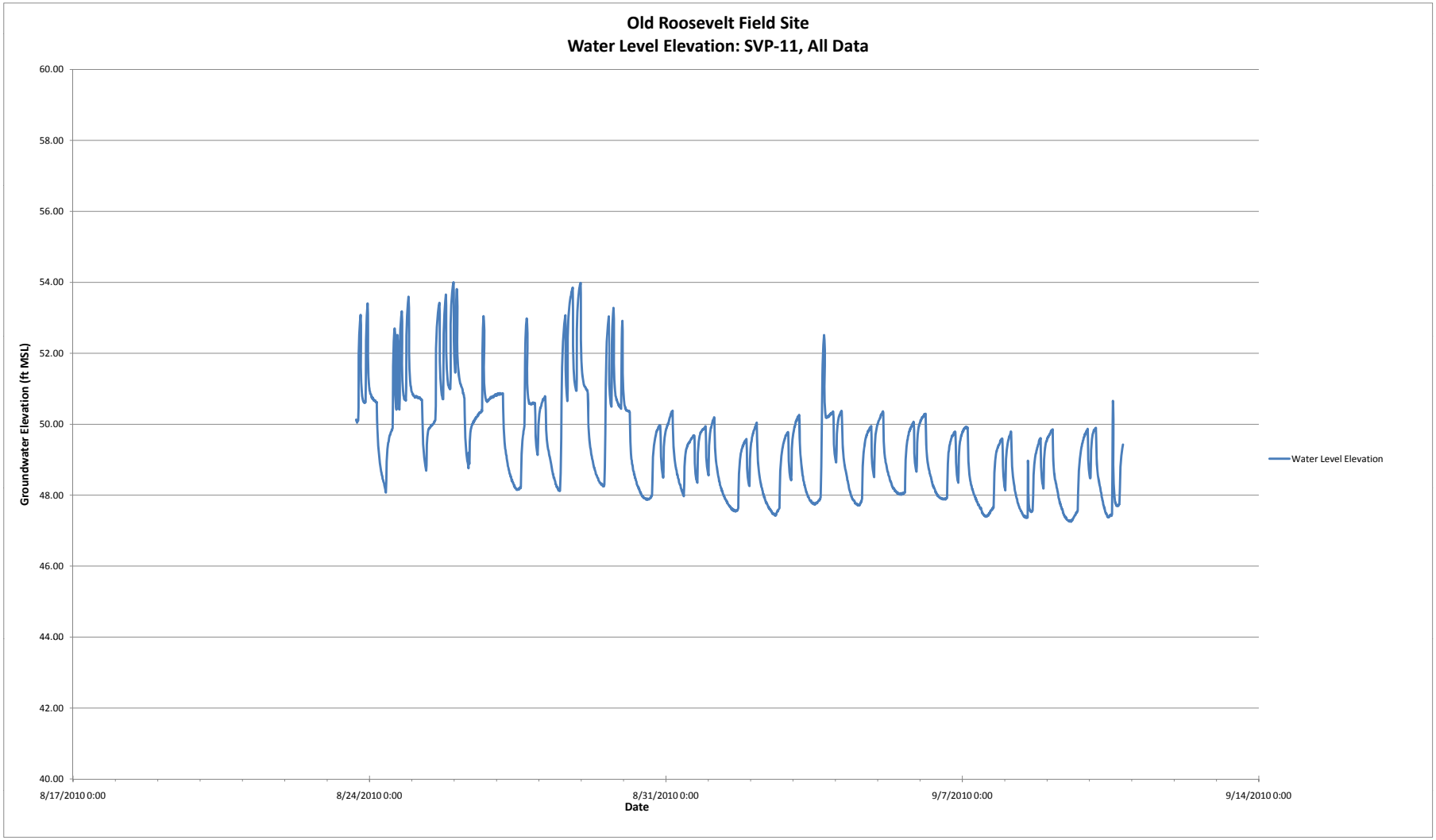

Old Roosevelt Field Site
Water Level Elevation: SVP-5, Draw Down and Recovery
Groundwater Elevation (ft MSL)
60
59
58
57
56
55
54
53
52
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Zone 1: 430 ft
Zone 3: 358 ft
Zone 5: 293 ft
Zone 8: 153 ft
Zone 10: 48 ft
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

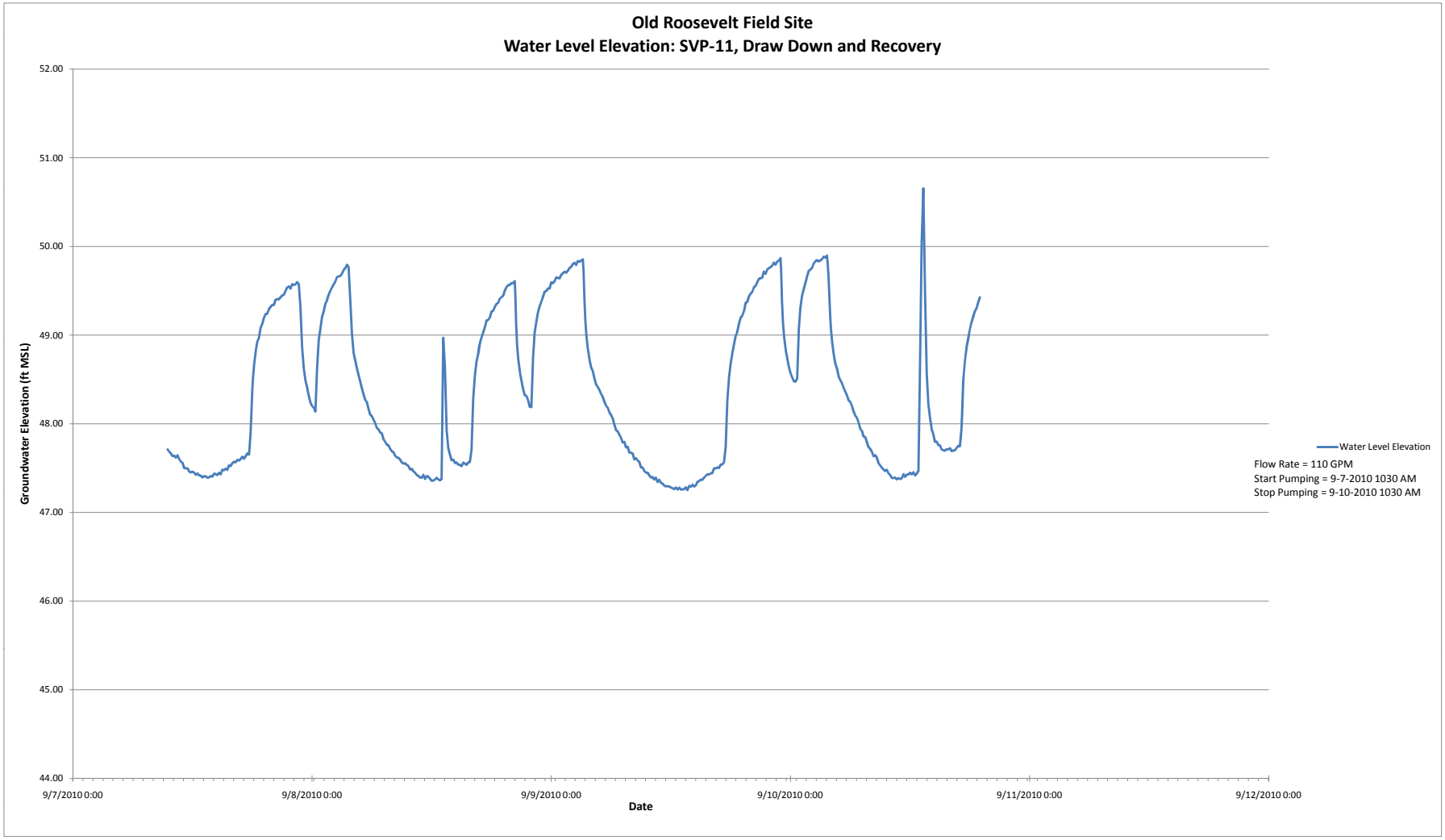

Old Roosevelt Field Site
Water Level Elevation: SVP-9, All Data
60.00
59.50
59.00
58.50
58.00
57.50
57.00
56.50
56.00
Groundwater Elevation (ft MSL)
8/21/2010 0:00
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Water Level Elevation


Old Roosevelt Field Site
Water Level Elevation: SVP-9, Draw Down and Recovery
Groundwater Elevation (ft MSL)
60.00
59.50
59.00
58.50
58.00
57.50
57.00
56.50
56.00
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM


Old Roosevelt Field Site
Water Level Elevation: SVP-10, All Data
Groundwater Elevation (ft MSL)
58
57
56
55
54
53
52
51
50
8/28/2010 0:00
9/4/2010 0:00
9/11/2010 0:00
9/18/2010 0:00
Date
Zone 1: 482 ft
Zone 3: 352 ft
Zone 5: 287 ft
Zone 8: 147 ft
Zone 10: 47 ft

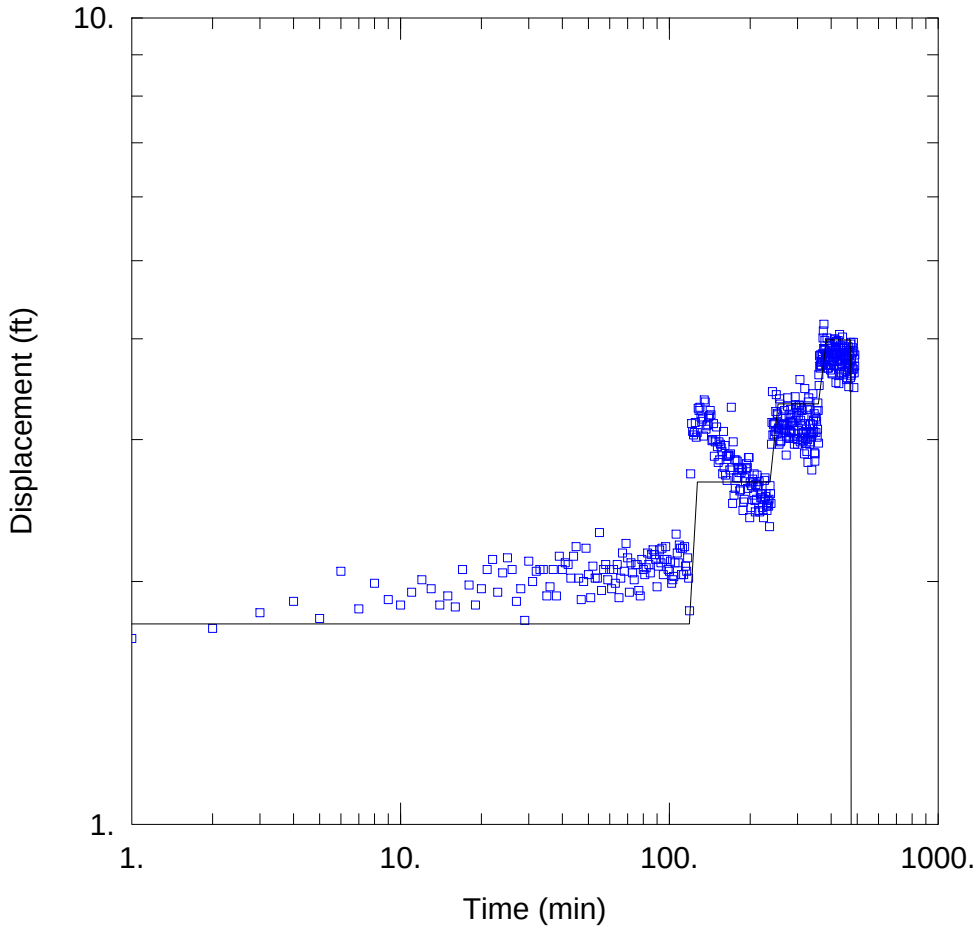

Old Roosevelt Field Site
Water Level Elevation: SVP-10, Draw Down and Recovery
Groundwater Elevation (ft MSL)
58
57
56
55
54
53
52
51
50
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Zone 1: 482 ft
Zone 3: 352 ft
Zone 5: 287 ft
Zone 8: 147 ft
Zone 10: 47 ft
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM


Old Roosevelt Field Site
Water Level Elevation: SVP-11, All Data
60.00
58.00
56.00
54.00
52.00
50.00
48.00
46.00
44.00
42.00
40.00
Groundwater Elevation (ft MSL)
8/17/2010 0:00
8/24/2010 0:00
8/31/2010 0:00
9/7/2010 0:00
9/14/2010 0:00
Date
Water Level Elevation


Old Roosevelt Field Site
Water Level Elevation: SVP-11, Draw Down and Recovery
52.00
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
Groundwater Elevation (ft MSL)
9/7/2010 0:00
9/8/2010 0:00
9/9/2010 0:00
9/10/2010 0:00
9/11/2010 0:00
9/12/2010 0:00
Date
Water Level Elevation
Flow Rate = 110 GPM
Start Pumping = 9-7-2010 1030 AM
Stop Pumping = 9-10-2010 1030 AM

Appendix G

Step Test Analyses



EW-1S

Data Set: C:\...\EW-1S_Step_Test.aqt
Date: 06/21/11 Time: 21:56:01

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

AQUIFER DATA

Saturated Thickness: 452. ft
Aquitard Thickness (b'): 20. ft
Anisotropy Ratio (Kz/Kr): 0.01
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.02	186070.8029

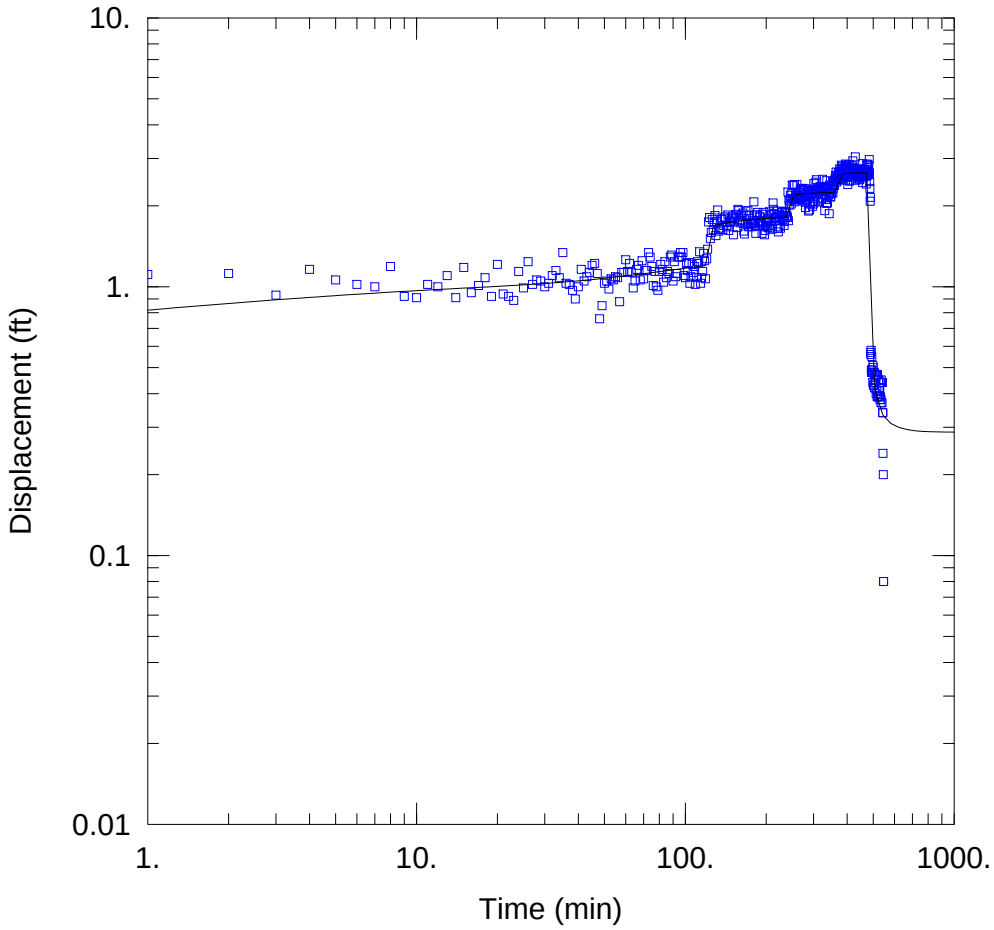
Observation Wells

Well Name	X (ft)	Y (ft)
EW-1S	2105932.02	186070.8029

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.716E+4 ft^2/day
r/B = 10.
C = 0. min^2/ft^5
S = 5.58E-5
Sw = 0.
P = 1.889



EW-1I

Data Set: C:\...\EW-1I_Step_Test.aqt
Date: 06/21/11 Time: 21:54:01

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

AQUIFER DATA

Saturated Thickness: 452. ft
Aquitard Thickness (b'): 20. ft
Anisotropy Ratio (Kz/Kr): 0.01
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1I	2105927.5	186080.2383

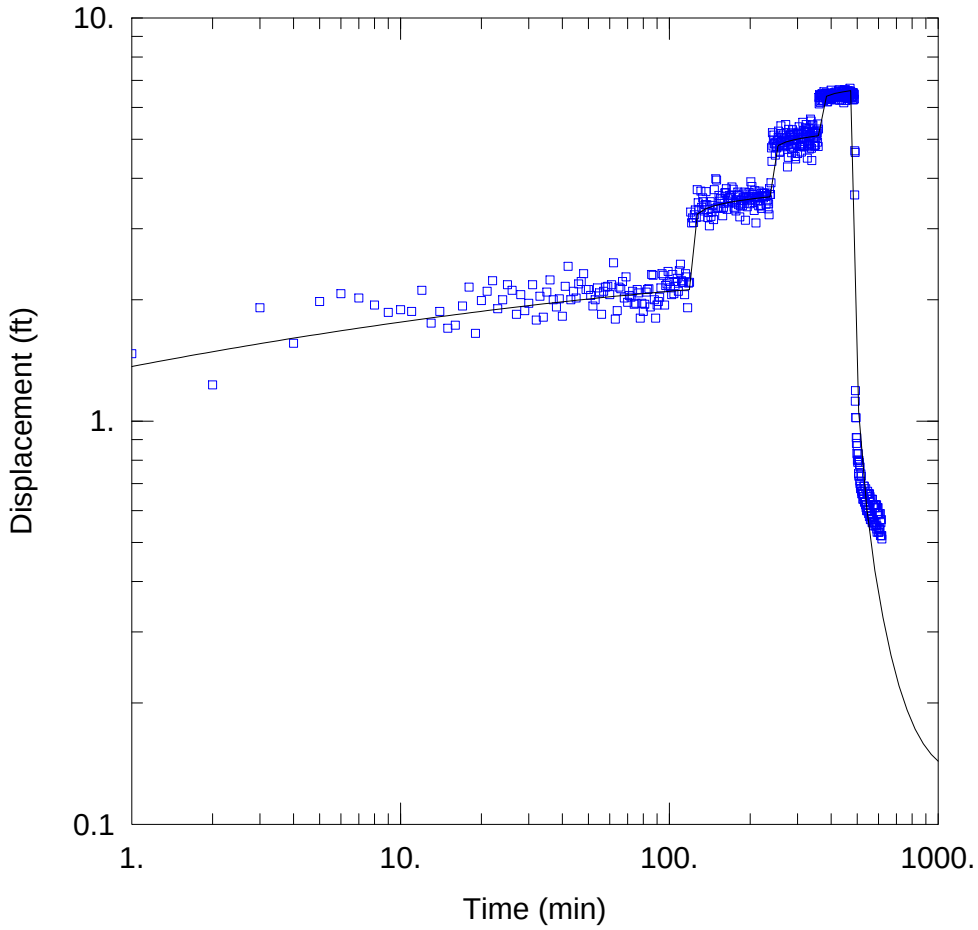
Observation Wells

Well Name	X (ft)	Y (ft)
EW-1I	2105927.5	186080.238

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 5.785E+4 ft^2/day
r/B = 0.8375
C = 0. min^2/ft^5
S = 0.0161
Sw = 0.
P = 1.917



EW-1D STEP TEST

Data Set: C:\...\EW-1D_Step_Test.aqt
Date: 06/21/11 Time: 21:51:29

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

AQUIFER DATA

Saturated Thickness: 452. ft
Anisotropy Ratio (Kz/Kr): 0.01
Aquitard Thickness (b'): 20. ft
Aquitard Thickness (b"): 1. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1D	2105923.03	186089.3509

Observation Wells

Well Name	X (ft)	Y (ft)
EW-1D	2105923.03	186089.3509

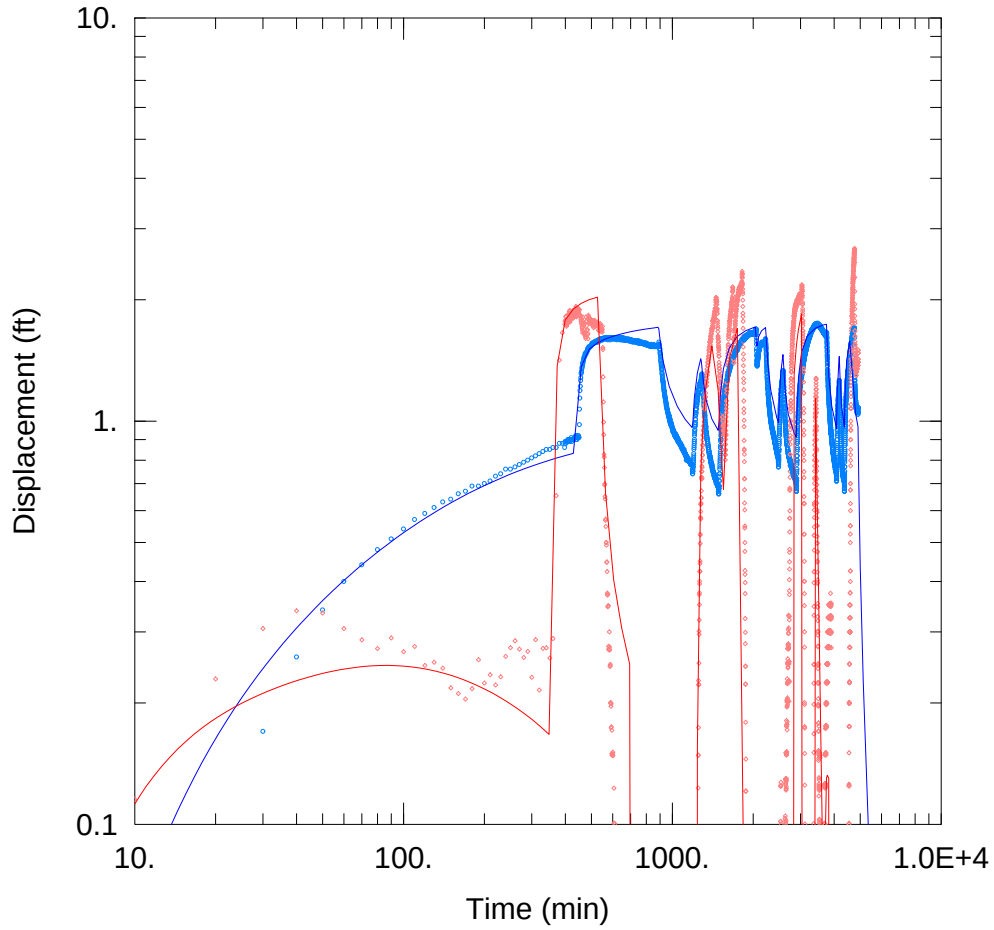
SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.858E+4 ft^2/day
S = 0.246
r/B = 2.787
Sw = 0.
C = 0. min^2/ft^5
P = 1.787

Appendix H

Extraction Well Pumping Well Data Analyses



GWX-10019, EW PUMPING

Data Set: C:\...\GWX-10019-EW_Pump_Test-HJ.aqt
Date: 06/24/11 Time: 15:01:17

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

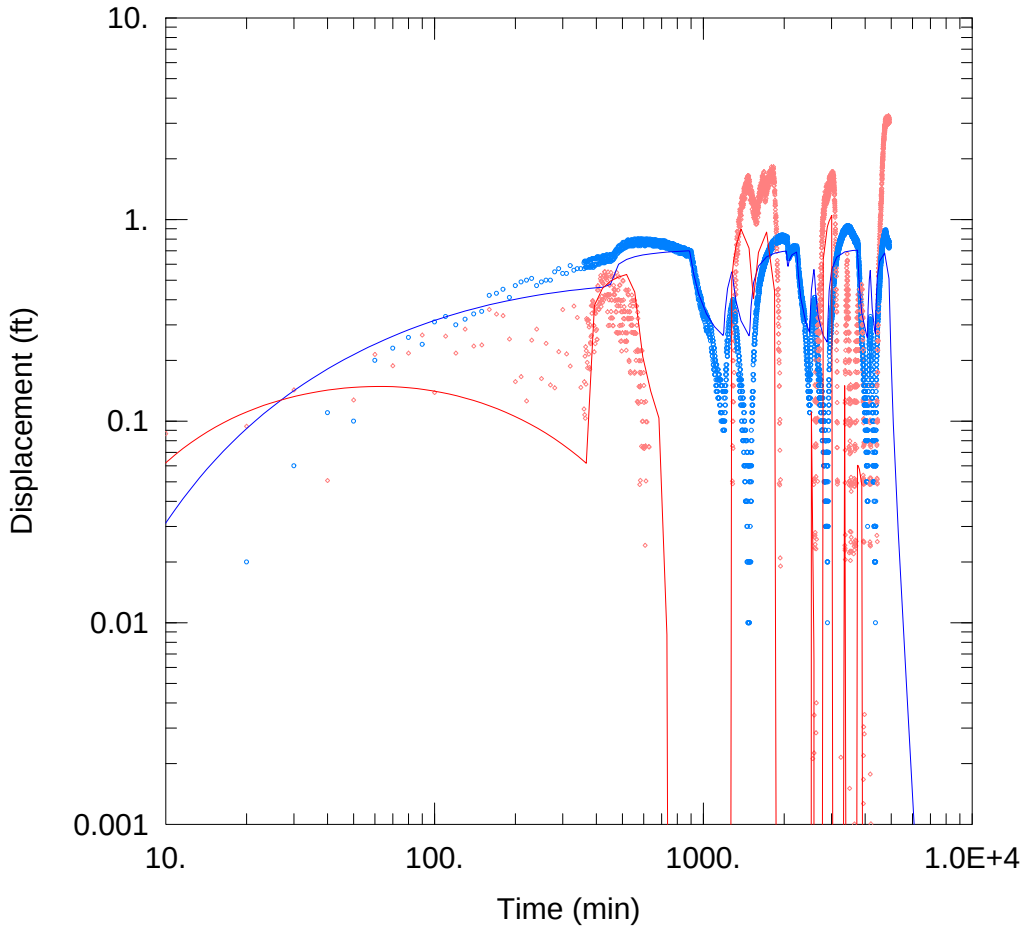
Observation Wells

Well Name	X (ft)	Y (ft)
◦ GWX-10019	2105876.5	185981.259

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.866E+4 ft^2/day
S = 0.0006809
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft



GWX-10020, EW PUMPING

Data Set: C:\...\GWX-10020-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 11:43:54

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

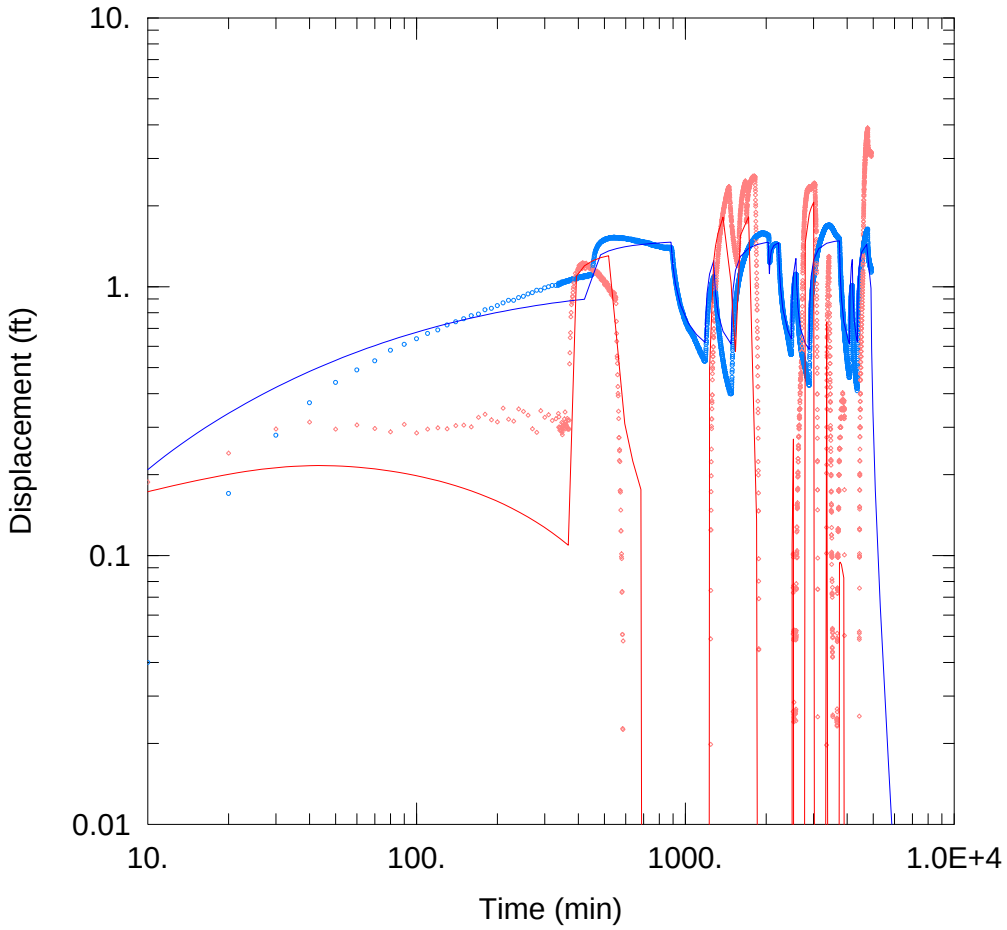
Observation Wells

Well Name	X (ft)	Y (ft)
GWX-10020	2106480.13	185775.454

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 7.464E+4 ft^2/day
S = 0.0007254
r/B = 0.1992
Kz/Kr = 0.01
b = 452. ft



MW-1S, EW PUMPING

Data Set: C:\...\MW-1S-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 16:27:28

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

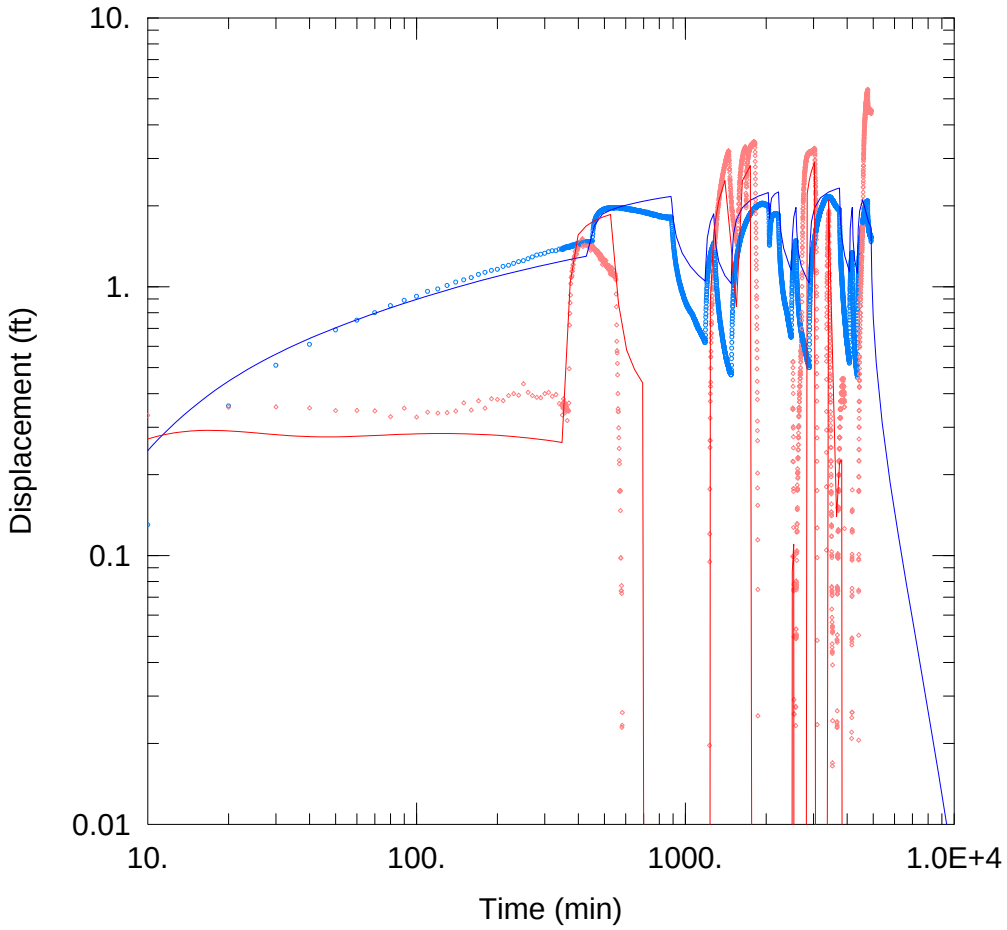
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-1S	2106106.4	186328.080

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 6.051E+4 ft^2/day
S = 0.0002997
r/B = 0.1199
Kz/Kr = 0.01
b = 452. ft



MW-1I, EW PUMPING

Data Set: C:\...\MW-1I-EW_Pump_Test-HJ.aqt
Date: 06/24/11 Time: 15:53:23

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

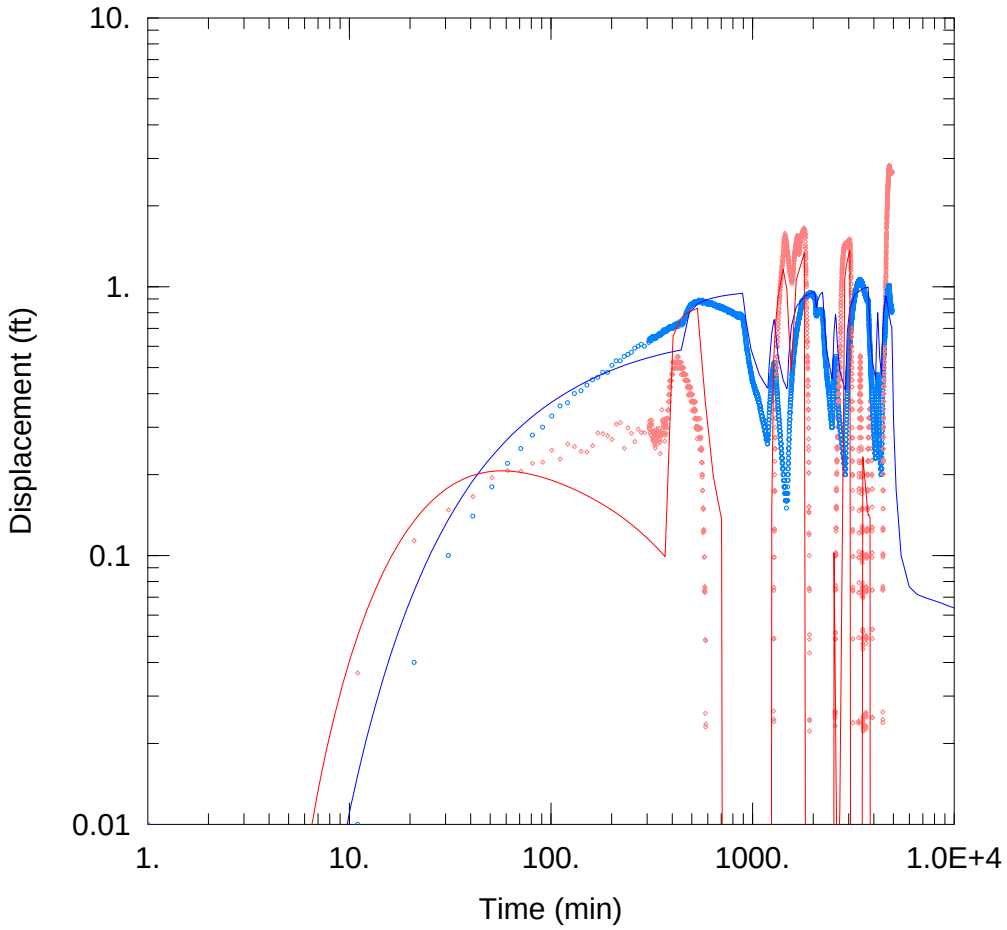
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-1I	2106083.1	186321.746

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.818E+4 ft^2/day
S = 0.0007946
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft



MW-2S, EW PUMPING

Data Set: C:\...\MW-2S-EW_Pump_Test-NU.aqt
Date: 06/26/11 Time: 16:18:59

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

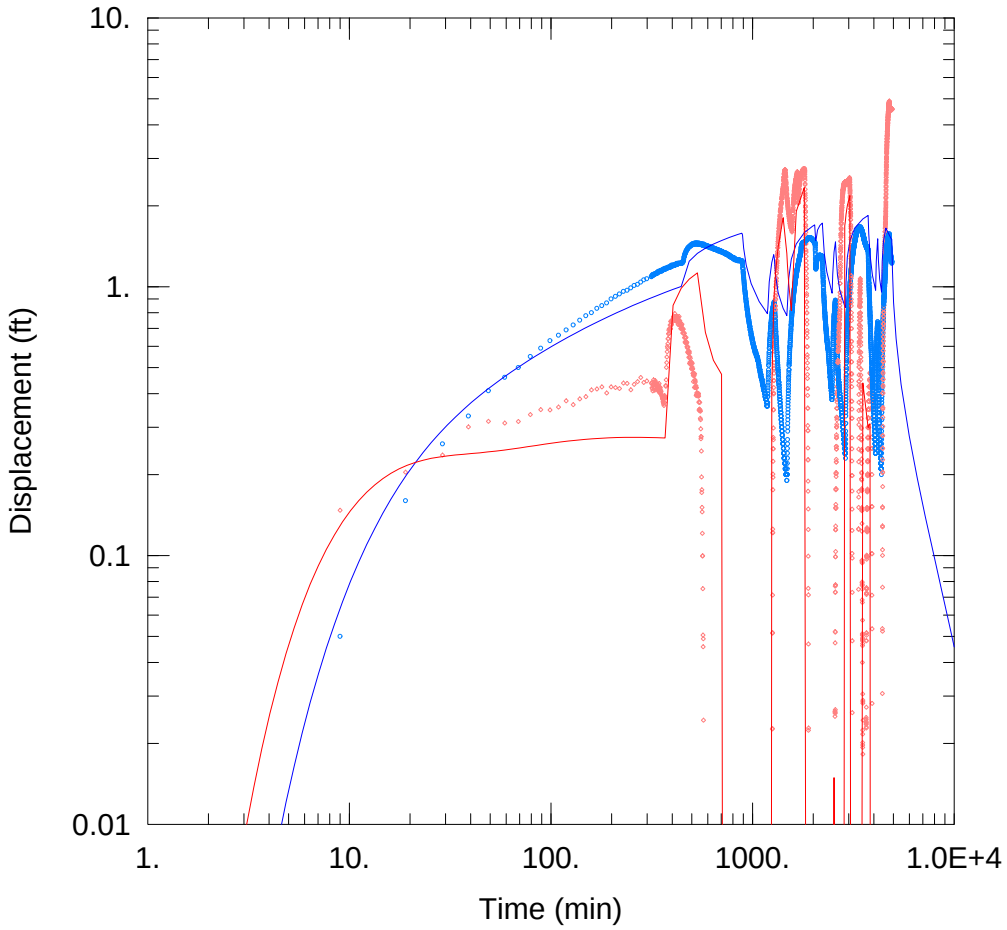
Observation Wells

Well Name	X (ft)	Y (ft)
MW-2S	2106577.5	186411.469

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 4.631E+4 ft^2/day
S = 0.001017
Sy = 0.0572
ß = 0.06



MW-2I, EW PUMPING

Data Set: C:\...\MW-2I-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 16:34:51

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

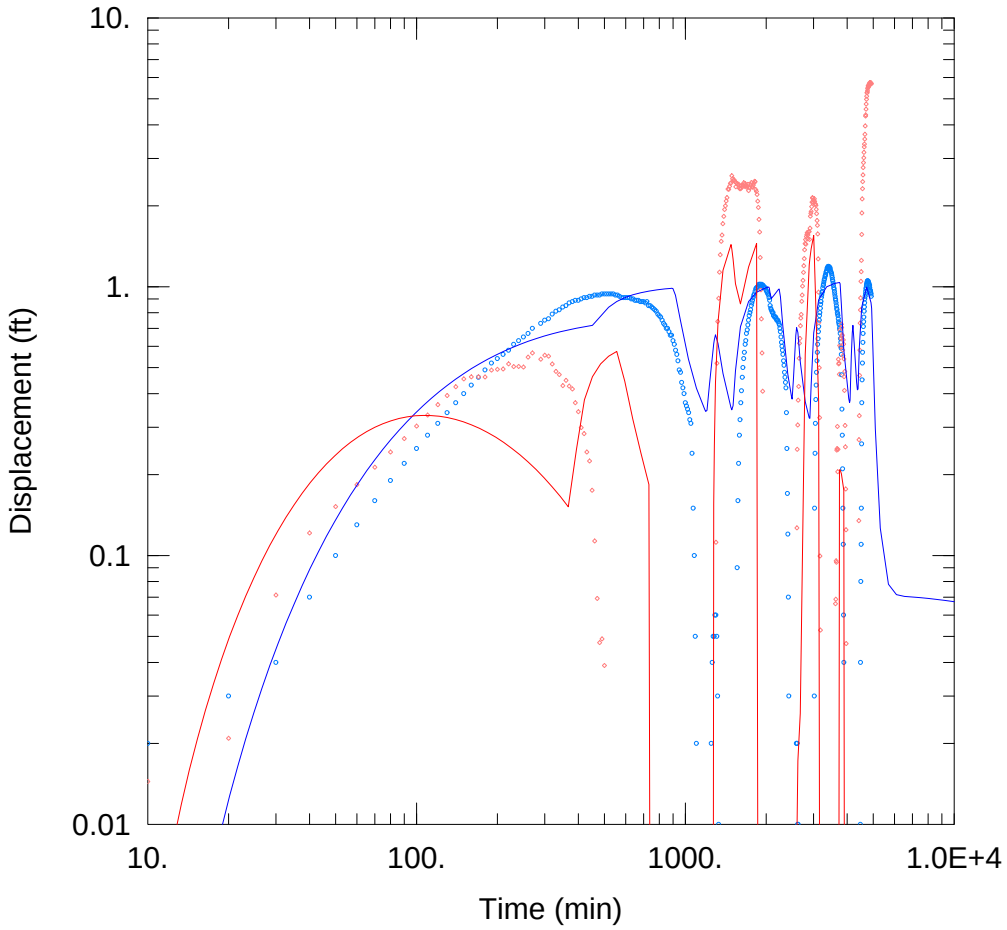
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-2I	2106564.0	186423.590

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 5.028E+4 ft^2/day
S = 0.001024
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft



MW-3S, EW PUMPING

Data Set: C:\...\MW-3S-EW_Pump_Test-NU.aqt
Date: 06/26/11 Time: 16:17:21

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

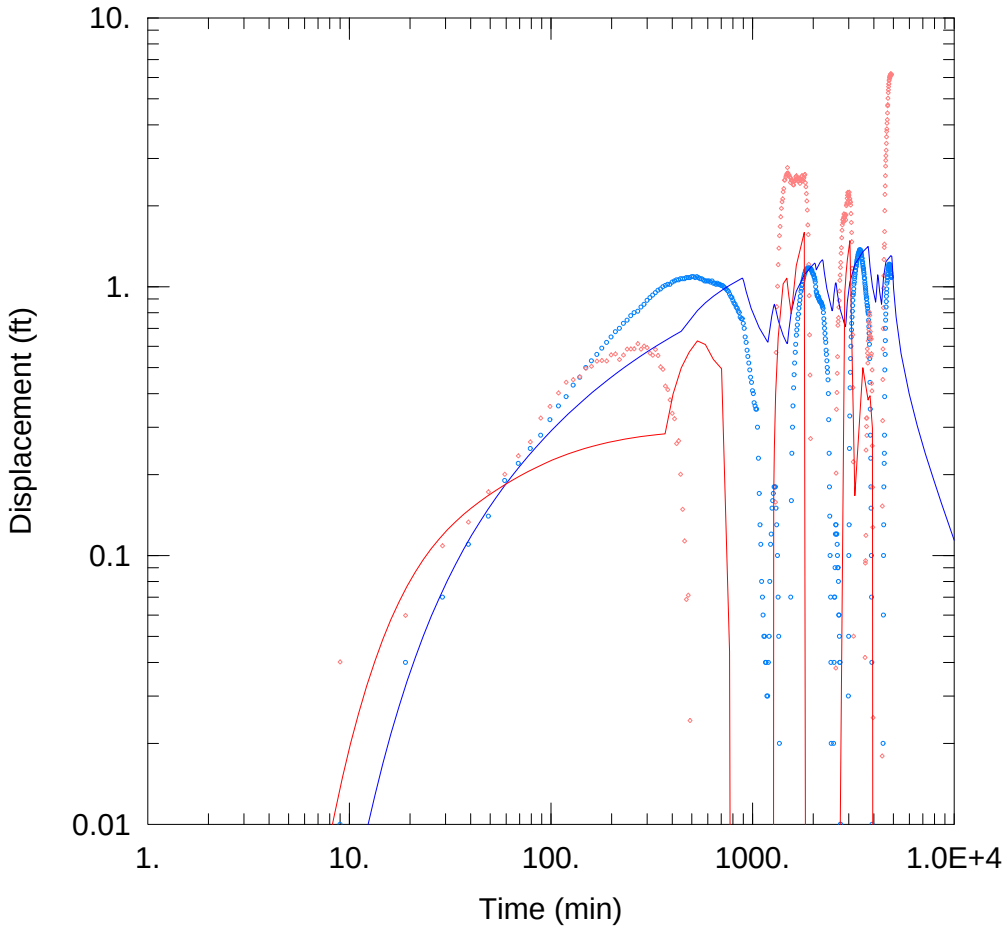
Observation Wells

Well Name	X (ft)	Y (ft)
MW-3S	2107725.8	185540.091

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2.05E+4 ft^2/day
S = 0.0004107
Sy = 0.0572
ß = 0.2269



MW-3I, EW PUMPING

Data Set: C:\...\MW-3I-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 15:54:11

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

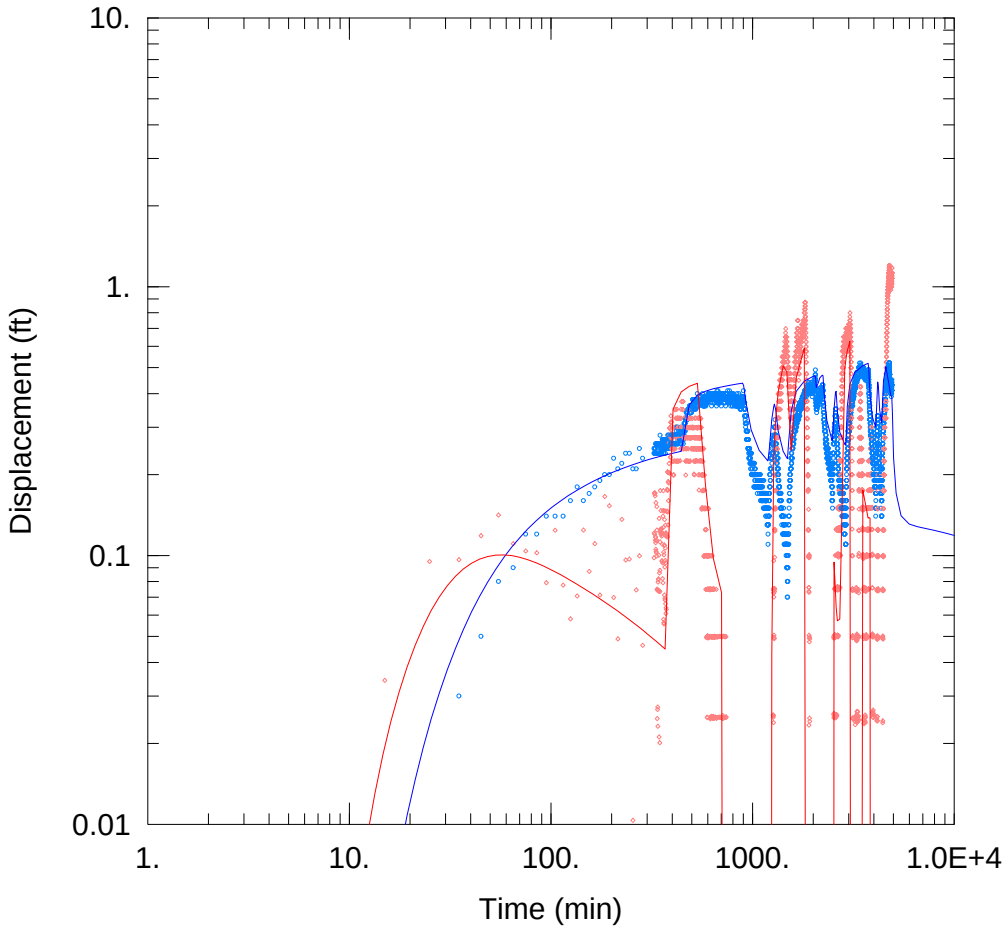
Well Name	X (ft)	Y (ft)
◦ MW-3I	2107740.05	185546.054

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.785E+4 ft^2/day
r/B = 0.1
b = 452. ft

S = 0.0009827
Kz/Kr = 0.01



SVP-10 PORT 8, EW PUMPING

Data Set: C:\...\SVP-10-8-EW_Pump_Test-NU.aqt
Date: 06/26/11 Time: 22:24:56

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

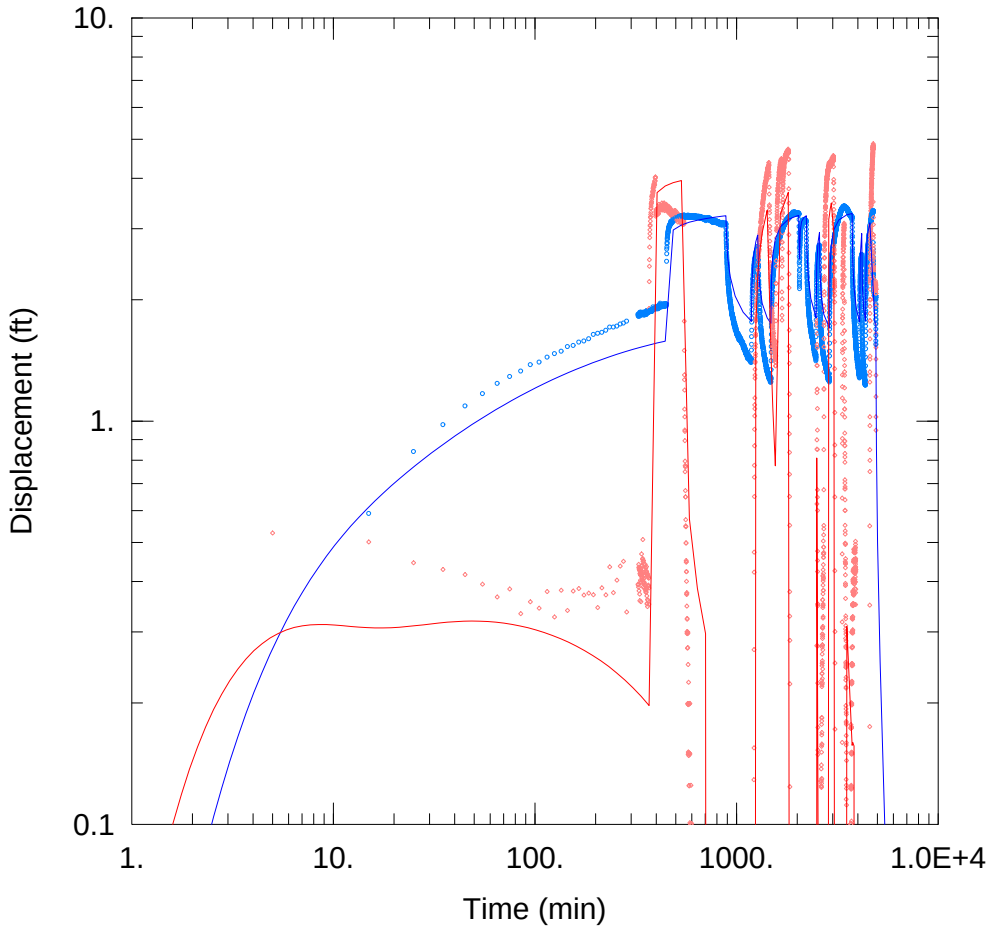
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-10-8	2105899.1	186072.675

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2.036E+4 ft^2/day
S = 0.0003179
Sy = 0.0572
ß = 0.01



SVP-10 PORT 5, EW PUMPING

Data Set: C:\...\SVP-10-5-EW_Pump_Test-HJ-rev.aqt
Date: 06/26/11 Time: 12:56:20

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

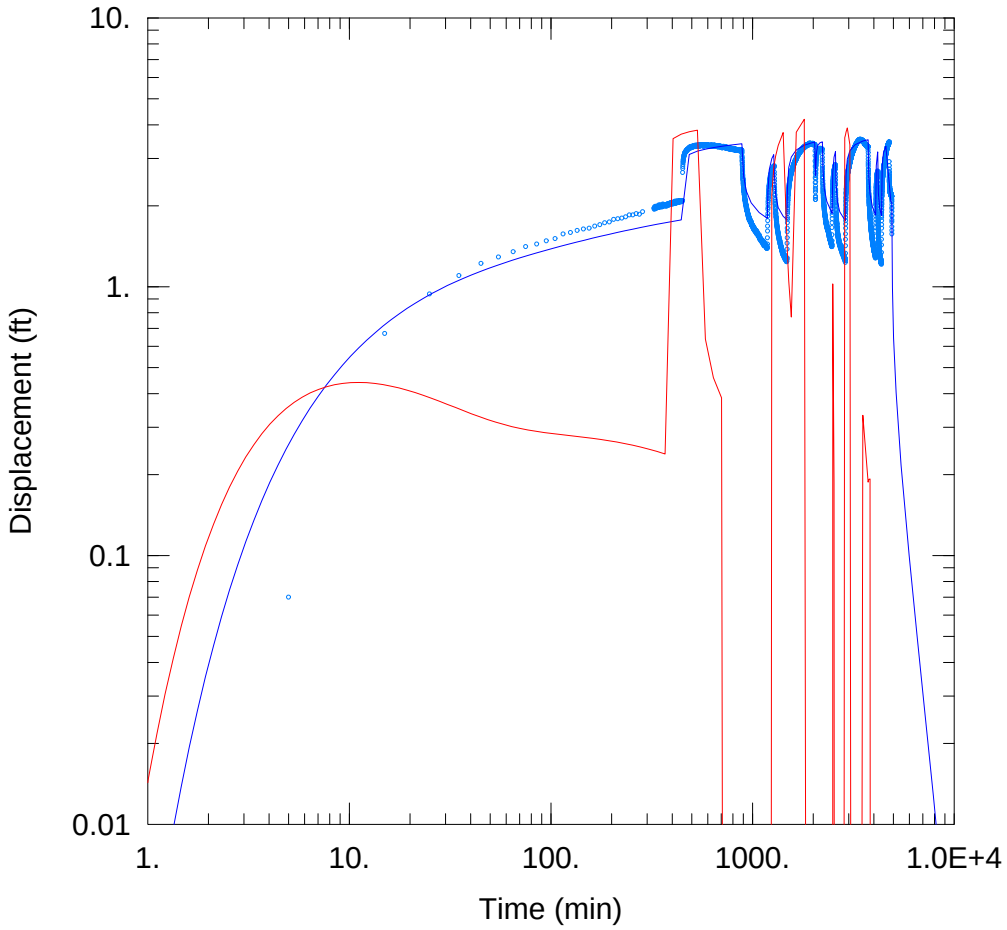
Well Name	X (ft)	Y (ft)
◦ SVP-10-5	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.217E+4 ft^2/day
r/B = 0.0798
b = 452. ft

S = 0.0003005
Kz/Kr = 0.01



SVP-10 PORT 3, EW PUMPING

Data Set: C:\...\SVP-10-3-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 13:06:31

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

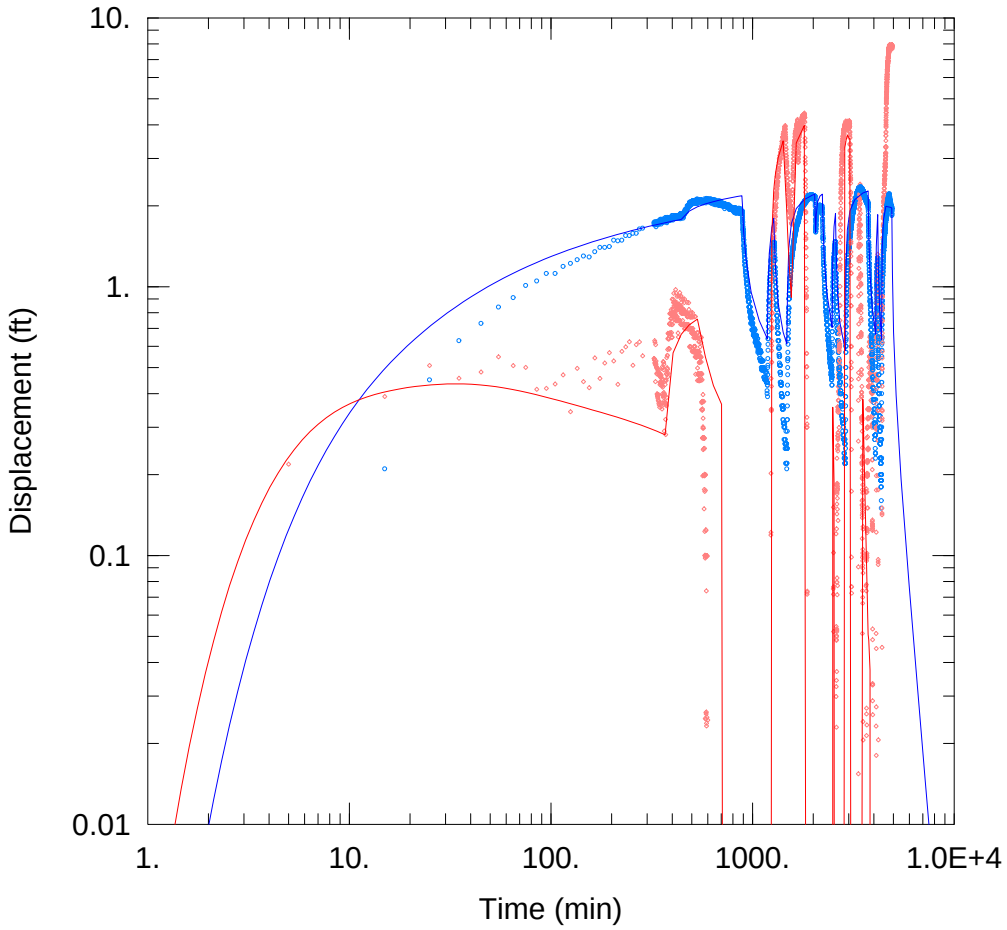
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-10-3	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.926E+4 ft^2/day
S = 0.001319
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft



SVP-10 PORT 1, EW PUMPING

Data Set: C:\...\SVP-10-1-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 15:41:15

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

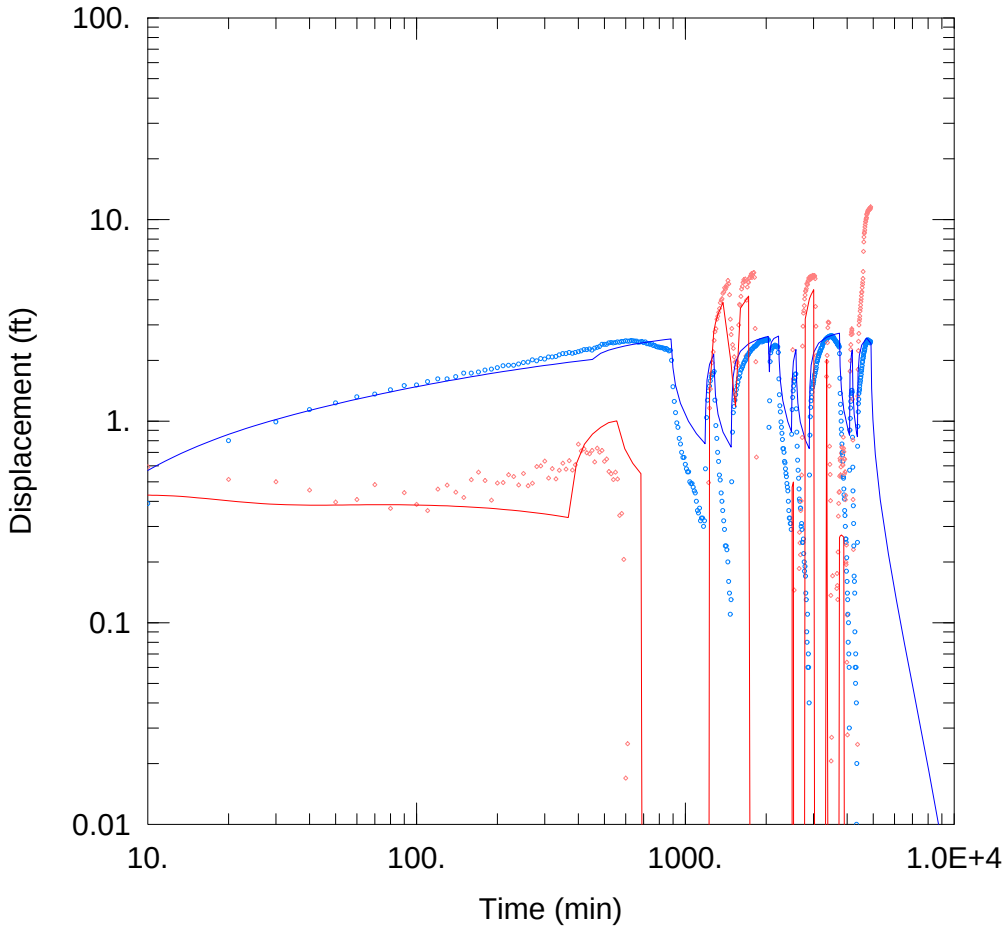
Well Name	X (ft)	Y (ft)
◦ SVP-10-1	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.133E+4 ft^2/day
r/B = 0.1
b = 452. ft

S = 0.0008352
Kz/Kr = 0.01



SVP-11 PORT 2, EW PUMPING

Data Set: C:\...\SVP-11-2-EW_Pump_Test-HJ.aqt
Date: 06/26/11 Time: 12:07:34

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

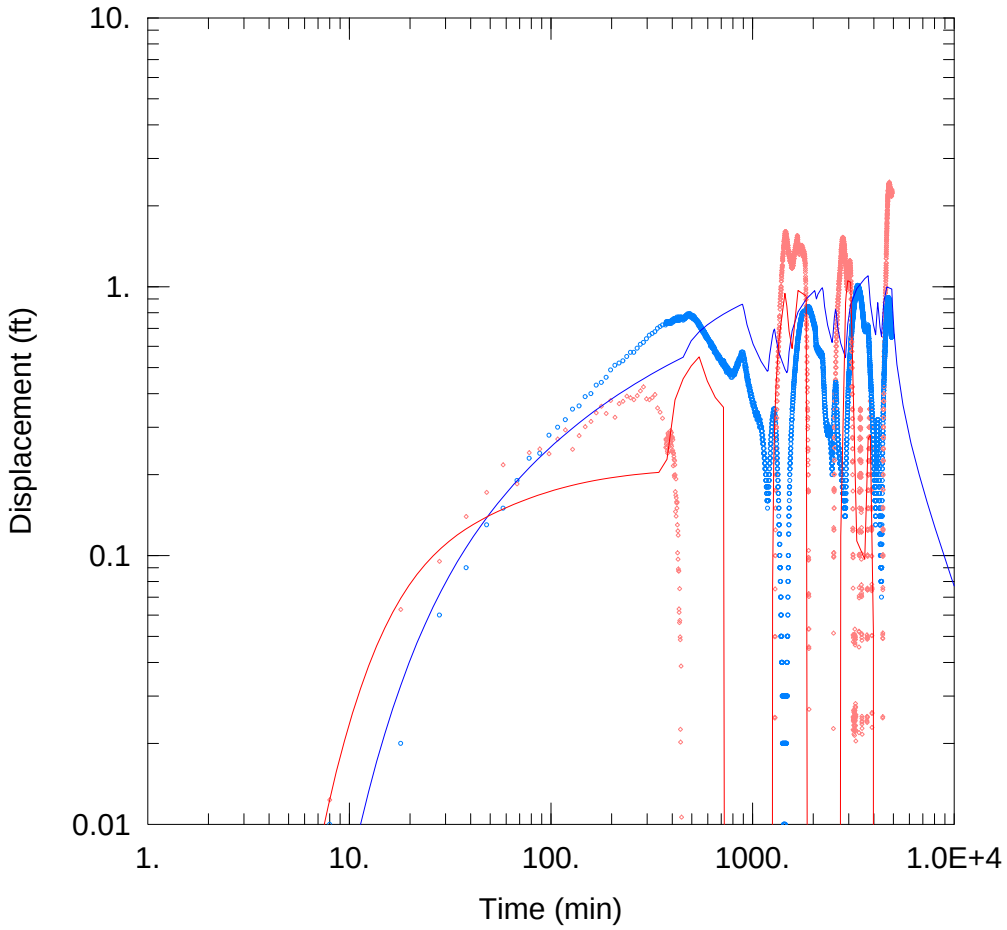
Well Name	X (ft)	Y (ft)
SVP-11-2	2105597.0	184603.935

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.6E+4 ft^2/day
r/B = 0.1
b = 452. ft

S = 0.0004336
Kz/Kr = 0.01



SVP-2 PORT 4, EW PUMPING

Data Set: C:\...\SVP-2-4-EW_Pump_Test-HJ.aqt
Date: 06/24/11 Time: 16:57:17

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

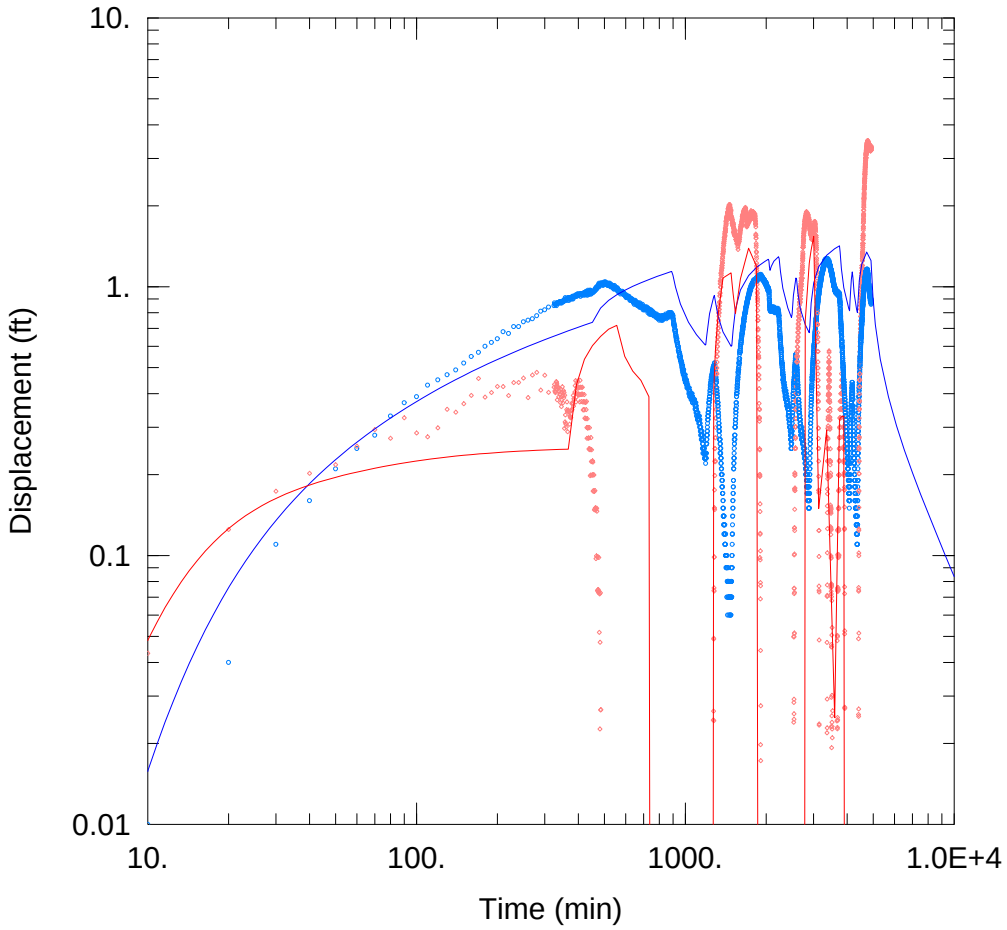
Well Name	X (ft)	Y (ft)
◦ SVP-2-4	2106214.4	187385.723

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 6.68E+4 ft^2/day
r/B = 0.1
b = 452. ft

S = 0.001531
Kz/Kr = 0.01



SVP-3 PORT 3, EW PUMPING

Data Set: C:\...\SVP-3-3-EW_Pump_Test-HJ.aqt
Date: 06/24/11 Time: 23:45:40

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

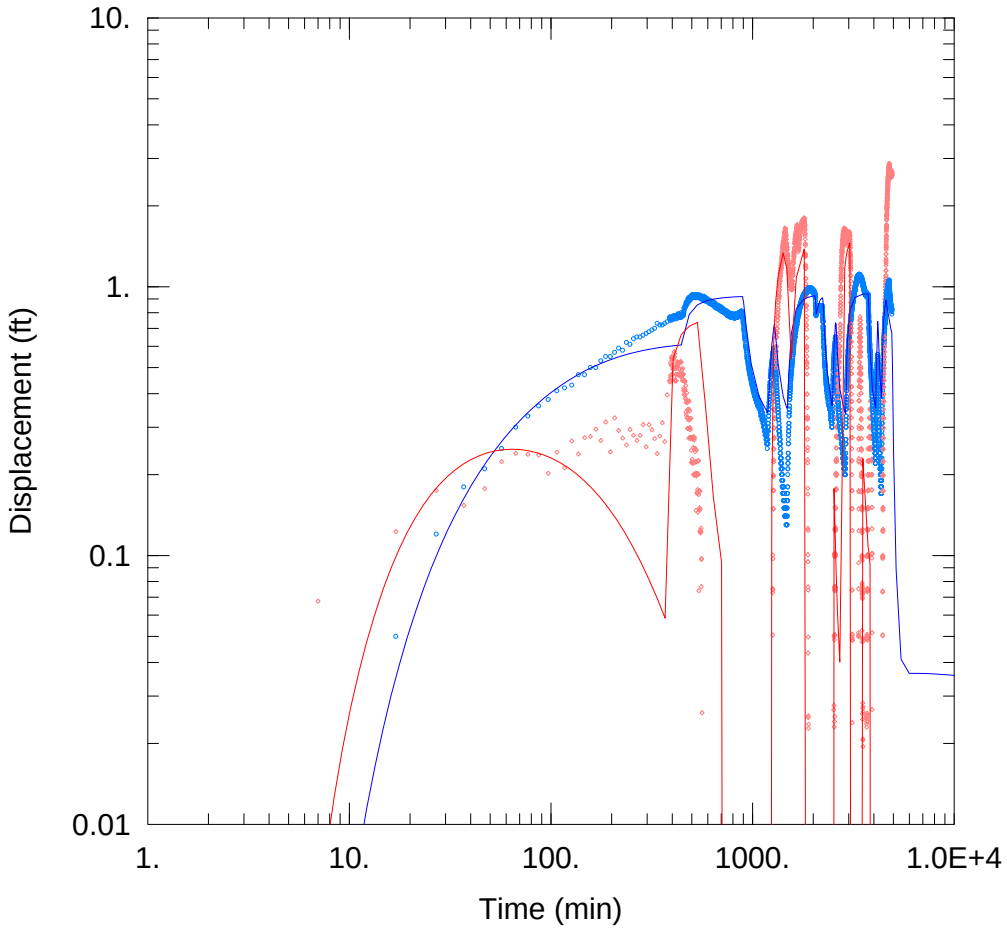
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-3-3	2106542.3	186966.005

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 5.543E+4 ft^2/day
S = 0.001375
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft



SVP-4 PORT 6, EW PUMPING

Data Set: C:\...\SVP-4-6-EW_Pump_Test-NU.aqt
Date: 06/26/11 Time: 17:03:18

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

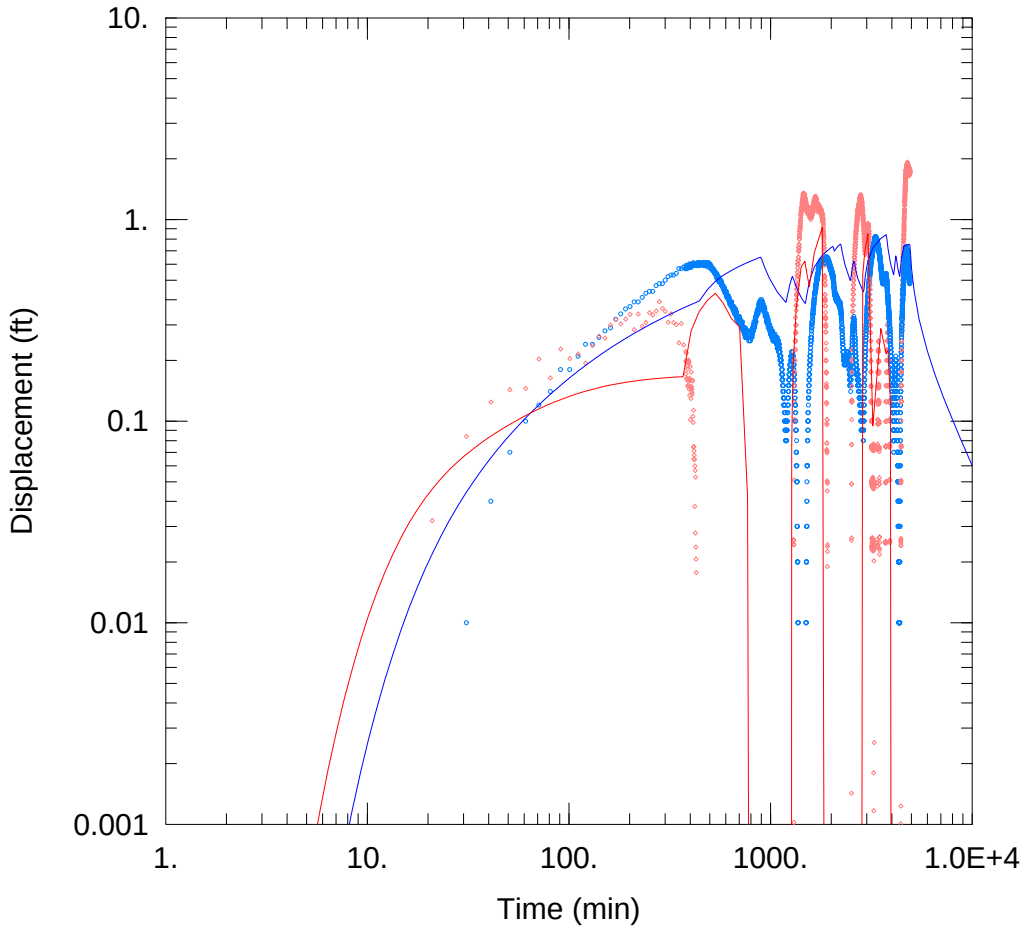
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-4-6	2105820.7	186882.689

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1.813E+4 ft^2/day
S = 0.0008573
Sy = 0.5
ß = 0.3149



SVP-9 PORT 5, EW PUMPING

Data Set: C:\...\SVP-9-5-EW_Pump_Test.-HJaqt.aqt
Date: 06/26/11 Time: 11:58:54

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: EW Pump Test
Test Date: 9/7-10/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553
EW-1S	2105932.0	186070.8029
EW-1I	2105927.5	186080.2383
EW-1D	2105923.0	186089.3509

Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-9-5	2105956.76	187687.257

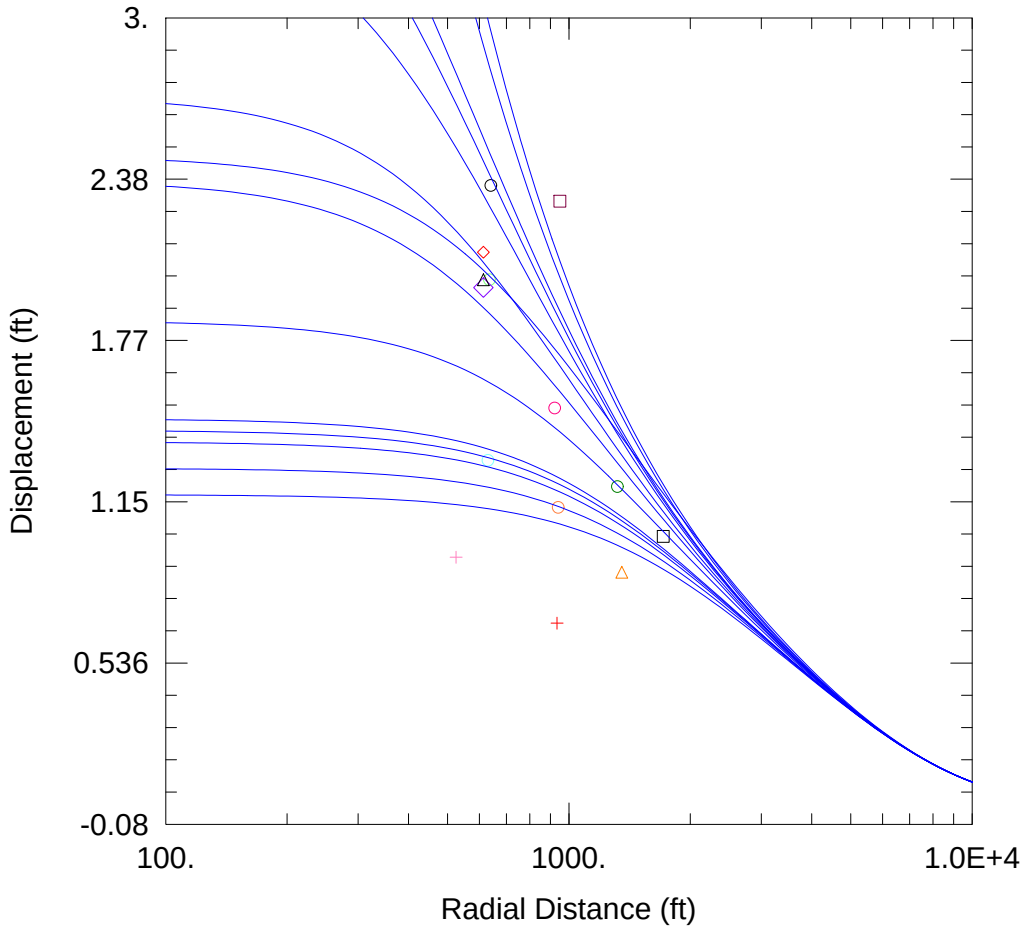
SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 8.243E+4 ft^2/day
S = 0.001421
r/B = 0.1
Kz/Kr = 0.01
b = 452. ft

Appendix I

GWP-10 Pumping Well Data Analyses



MULTIPLE WELLS, GWP-10 PUMPING

Data Set: C:\...\Distance_Drawdown_All-Points_GWP-10_Pumping-HJ.aqt
Date: 06/22/11 Time: 13:11:03

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

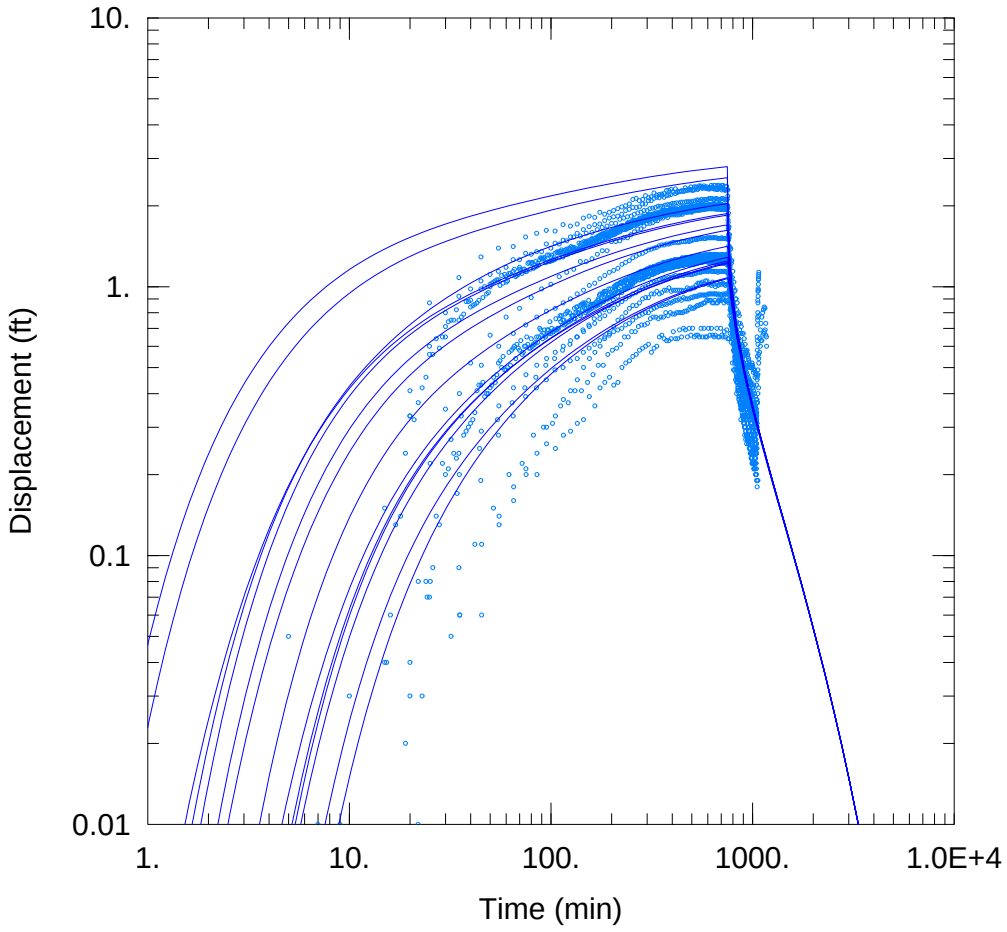
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

Observation Wells

Well Name	X (ft)	Y (ft)
○ EW-1D	2105923.03	186089.350
○ EW-1I	2105927.56	186080.238
○ EW-1S	2105932.02	186070.802
+ GWX-10019	2105876.58	185981.259
+ GWX-10020	2106480.13	185775.454
○ MW-1S	2106106.40	186328.080
○ MW-1I	2106083.14	186321.746
○ MW-2I	2106564.06	186423.590
□ SVP-3-3	2106542.34	186966.005
△ SVP-4-6	2105820.76	186882.689
◇ SVP-10-1	2105899.13	186072.675
◇ SVP-10-3	2105899.13	186072.675
△ SVP-10-5	2105899.13	186072.675
□ SVP-11-3	2105597.01	184603.935



MULTIPLE WELLS, GWP-10 PUMPING

Data Set: C:\...\Multiple_Wells_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:54:07

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

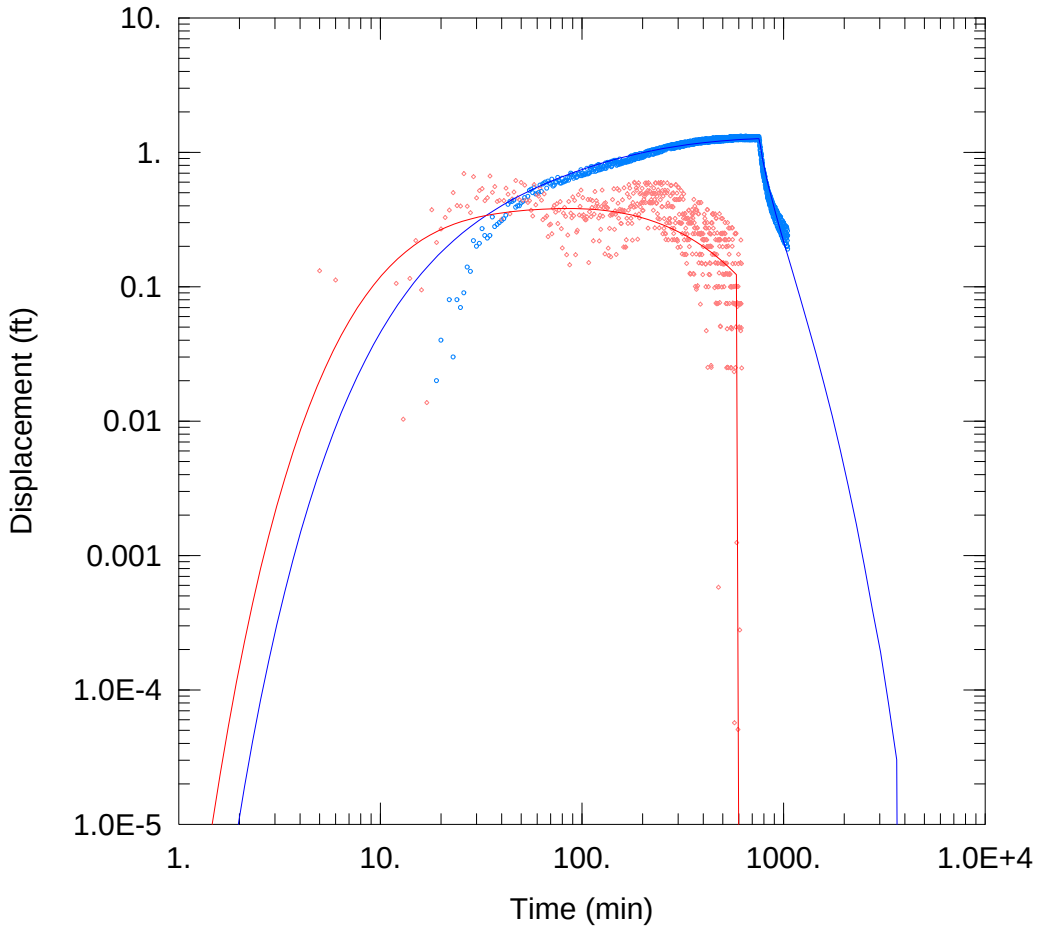
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

Observation Wells

Well Name	X (ft)	Y (ft)
◦ EW-1D	2105923.03	186089.350
◦ EW-1I	2105927.50	186080.238
◦ EW-1S	2105932.02	186070.802
◦ GWX-10019	2105876.58	185981.259
◦ GWX-10020	2106480.13	185775.454
◦ MW-1S	2106106.40	186328.080
◦ MW-1I	2106083.14	186321.746
◦ MW-2I	2106564.06	186423.590
◦ SVP-3-3	2106542.34	186966.005
◦ SVP-4-6	2105820.76	186882.689
◦ SVP-10-1	2105899.13	186072.675
◦ SVP-10-3	2105899.13	186072.675
◦ SVP-10-5	2105899.13	186072.675
◦ SVP-11-2	2105597.01	184603.935



EW-1S, GWP-10 PUMPING

Data Set: C:\...\EW-1S_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:10:09

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

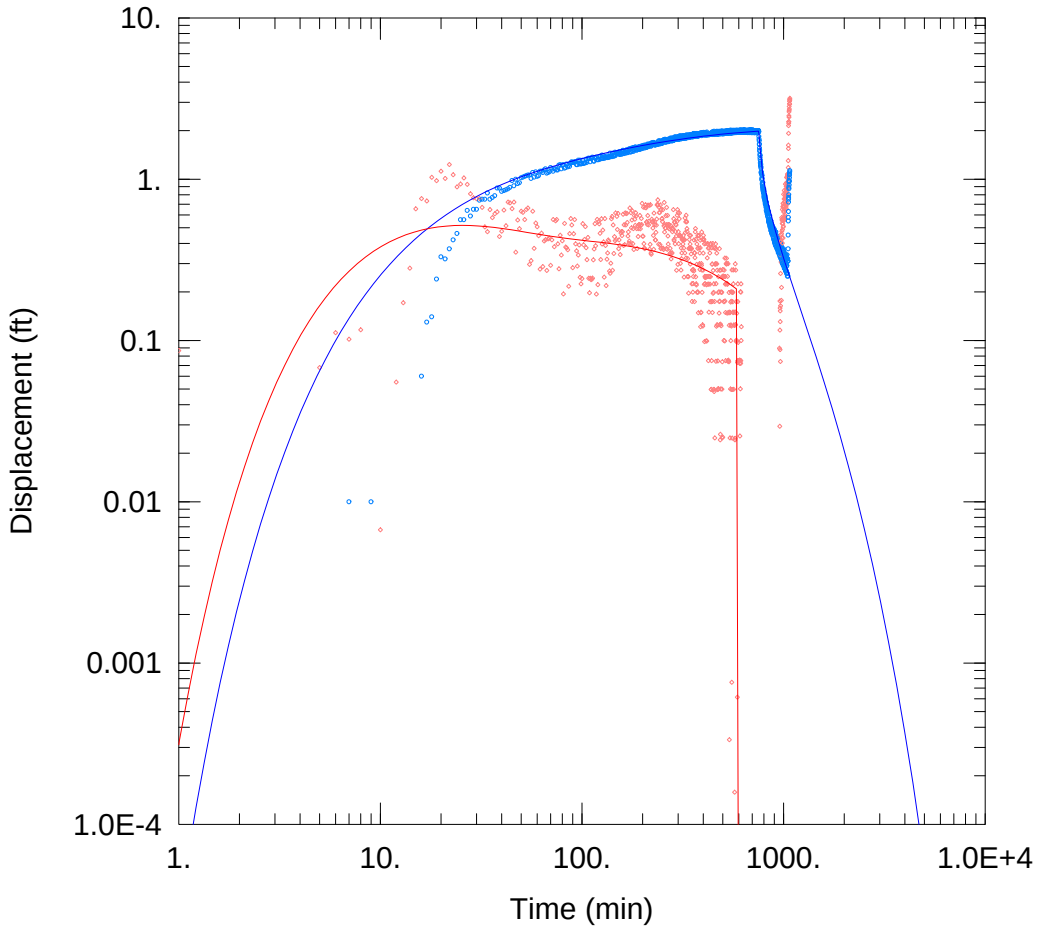
Observation Wells

Well Name	X (ft)	Y (ft)
EW-1S	2105932.02	186070.802

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.618E+4 ft^2/day
S = 0.000658
r/B = 0.1958
Kz/Kr = 0.01
b = 452. ft



EW-1I, GWP-10 PUMPING

Data Set: C:\...\EW-1I_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:02:25

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

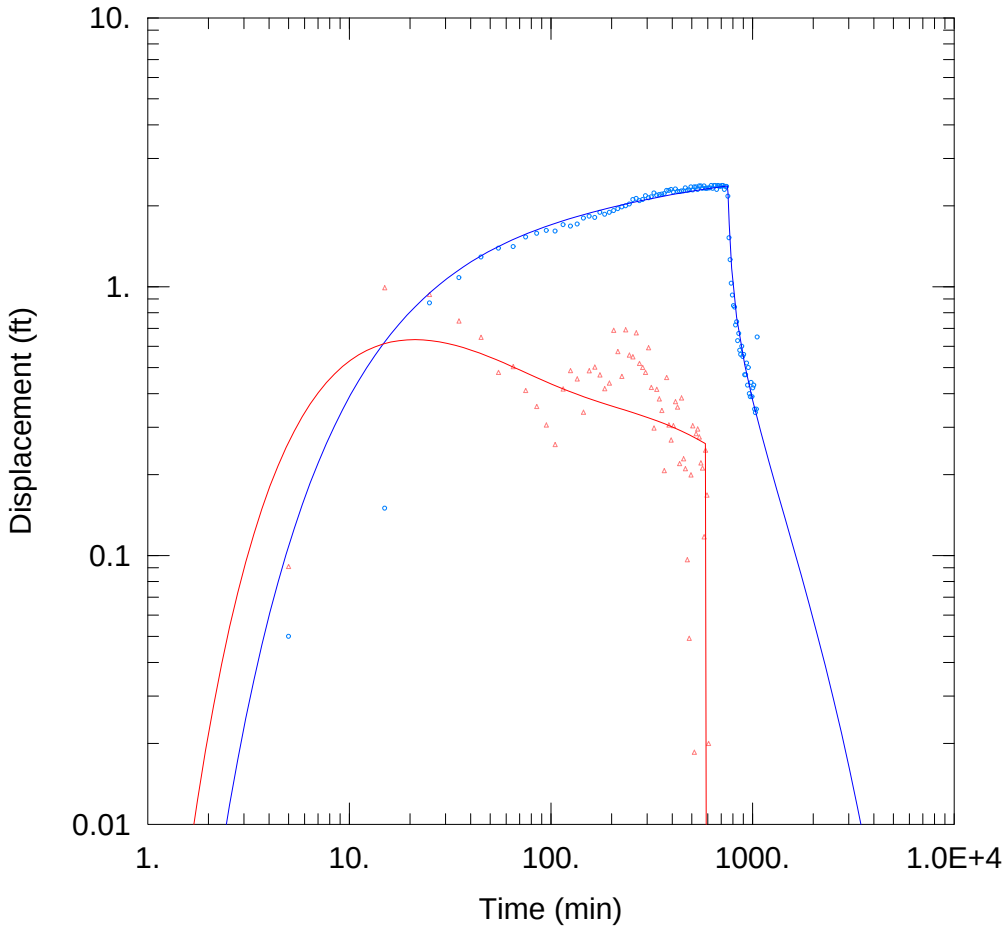
Observation Wells

Well Name	X (ft)	Y (ft)
◦ EW-1I	2105927.5	186080.238

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.856E+4 ft^2/day
S = 0.000949
r/B = 0.1756
Kz/Kr = 0.01
b = 452. ft



EW-1D, GWP-10 PUMPING

Data Set: C:\...\EW-1D_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 21:59:42

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

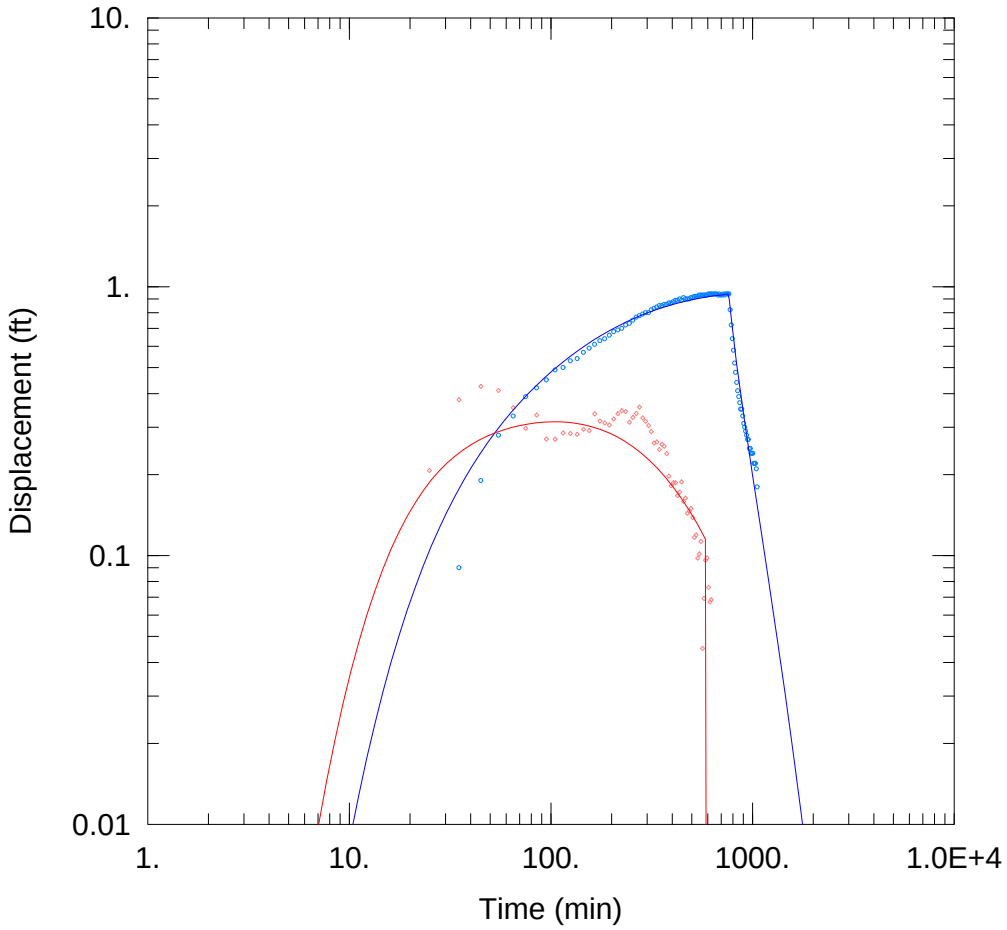
Observation Wells

Well Name	X (ft)	Y (ft)
EW-1D	2105923.03	186089.350

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.736E+4 ft^2/day
S = 0.002363
r/B = 0.1682
Kz/Kr = 0.01
b = 452. ft



GWX-10019, GWP-10 PUMPING

Data Set: C:\...\GWX-10019-GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:12:26

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

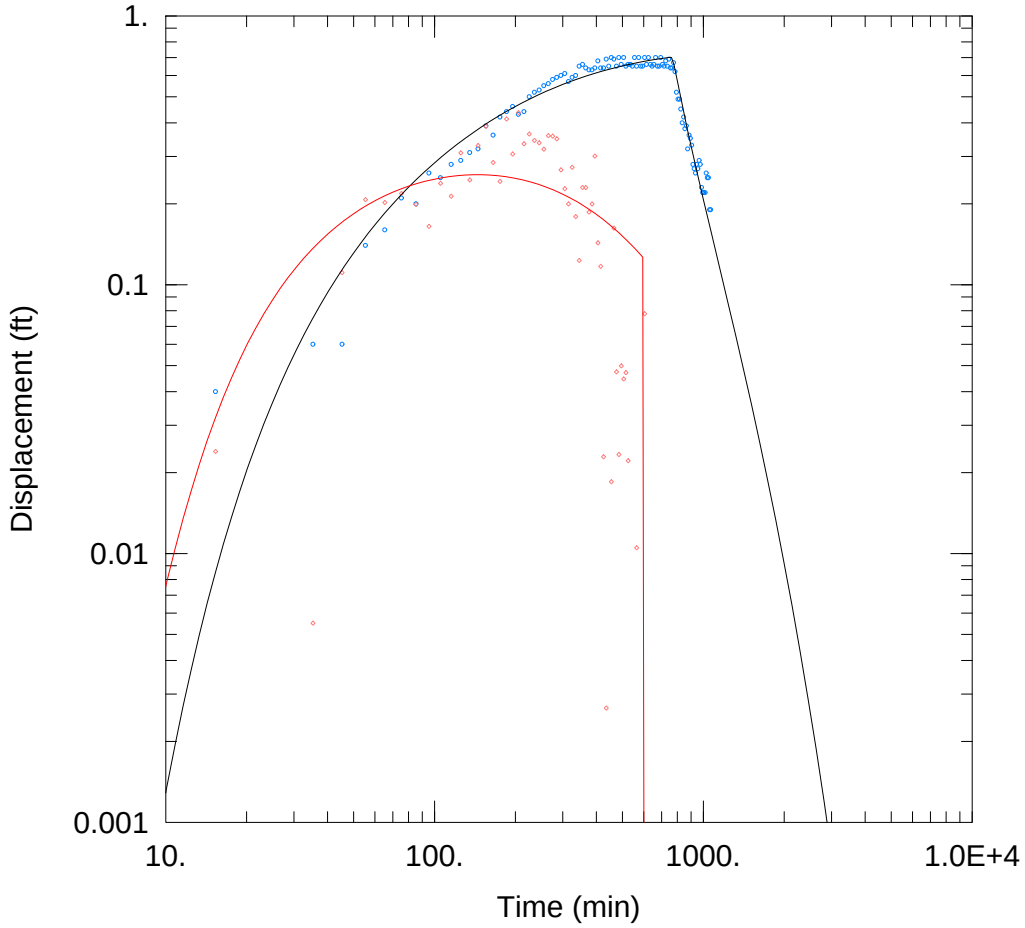
Observation Wells

Well Name	X (ft)	Y (ft)
◦ GWX-10019	2105876.58	185981.259

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.968E+4 ft^2/day
S = 0.0009774
r/B = 0.1831
Kz/Kr = 0.01
b = 452. ft



GWX-10020, GWP-10 PUMPING

Data Set: C:\...\GWX-10020-GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:13:37

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

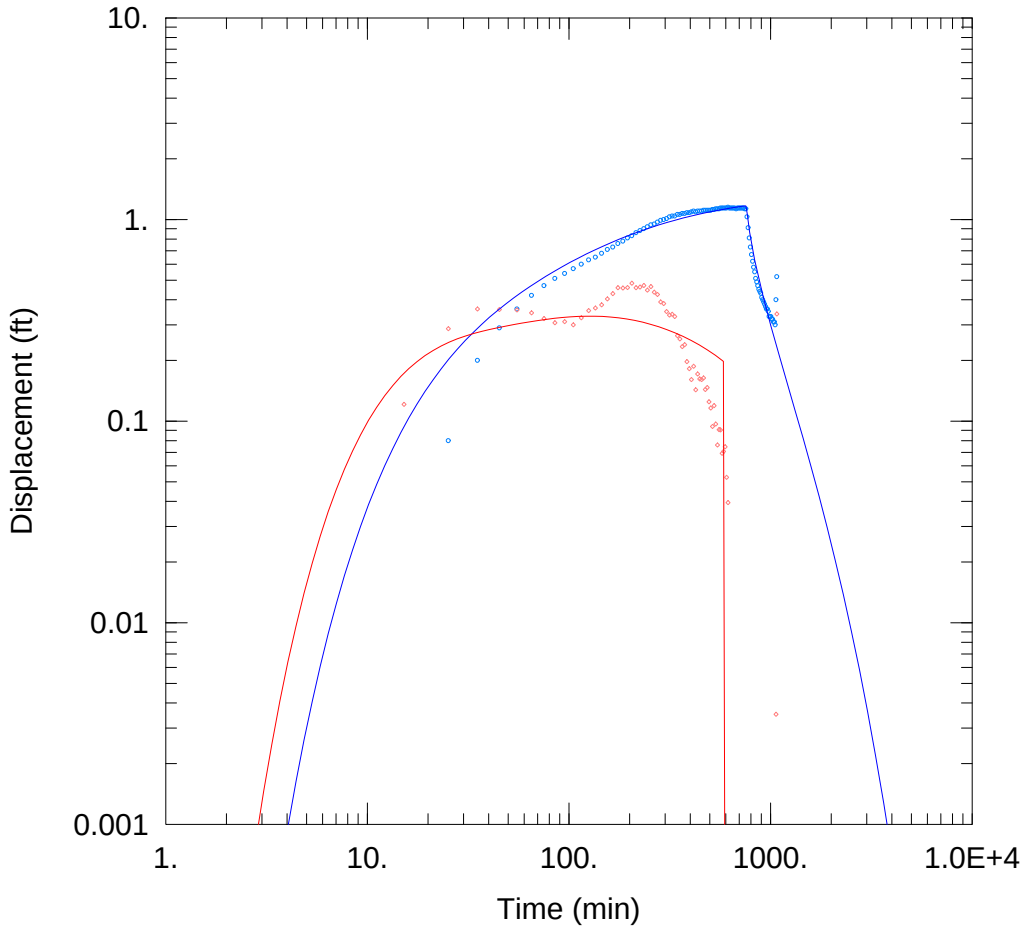
Observation Wells

Well Name	X (ft)	Y (ft)
GWX-10020	2106480.13	185775.454

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.688E+4 ft^2/day
S = 0.00114
r/B = 0.2764
Kz/Kr = 0.01
b = 452. ft



MW-1S, GWP-10 PUMPING

Data Set: C:\...\MW-1S_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:29:38

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

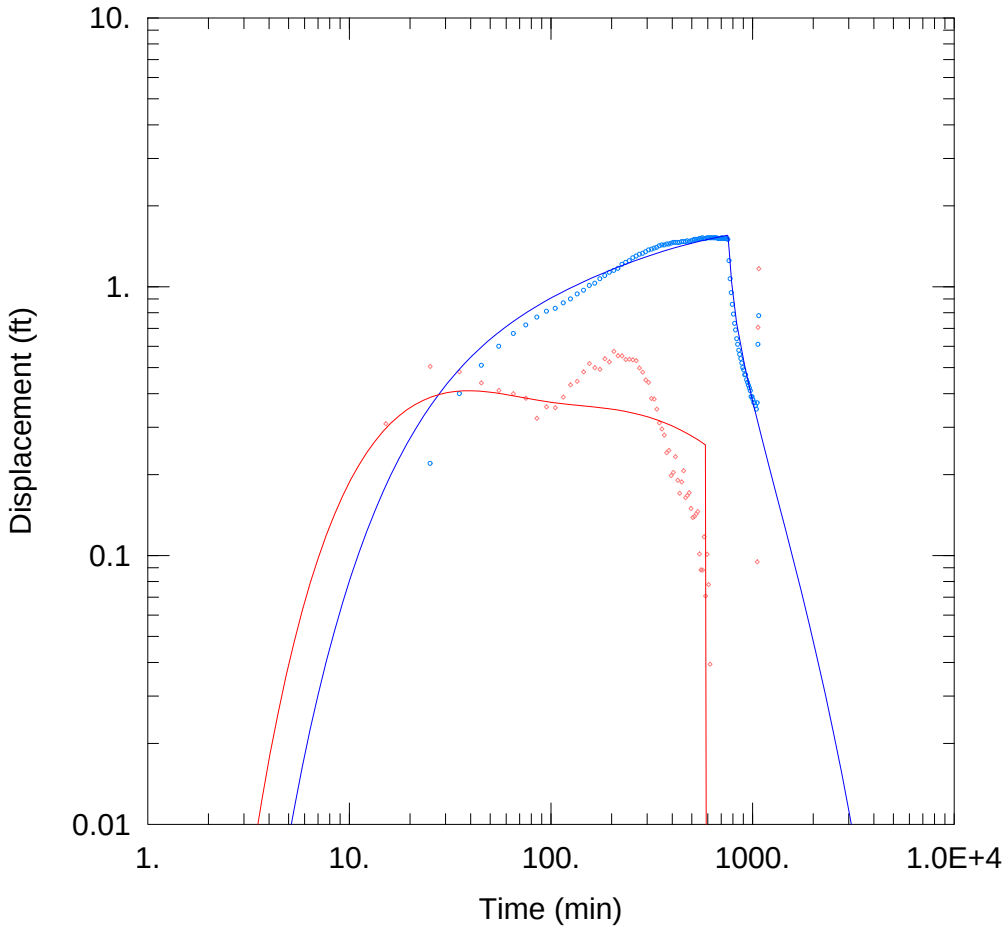
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-1S	2106106.4(	186328.080

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.447E+4 ft^2/day
S = 0.0007684
r/B = 0.1967
Kz/Kr = 0.01
b = 452. ft



MW-1I, GWP-10 PUMPING

Data Set: C:\...\MW-1I_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:21:26

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

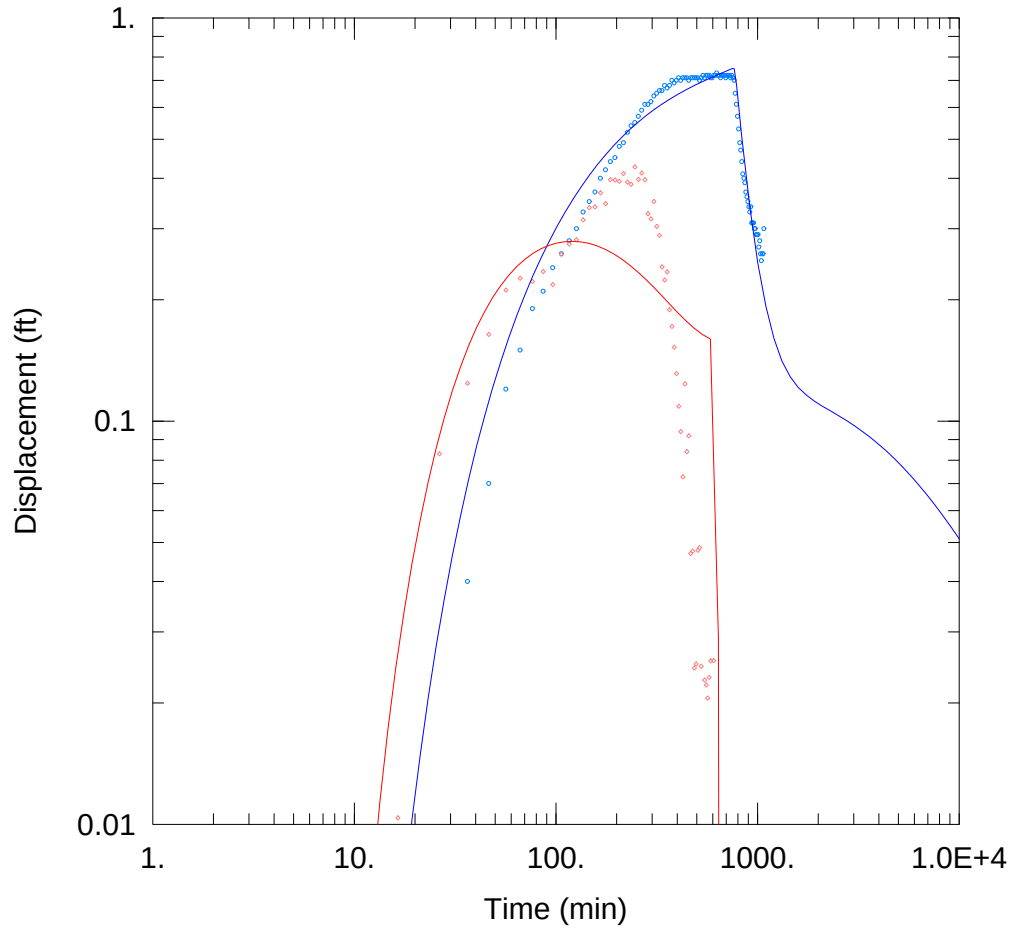
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-1I	2106083.14	186321.746

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.327E+4 ft^2/day
S = 0.001356
r/B = 0.2179
Kz/Kr = 0.01
b = 452. ft



MW-2S, GWP-10 PUMPING

Data Set: C:\...\MW-2S_GWP-10_Pumping-NU.aqt
Date: 06/26/11 Time: 22:41:19

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

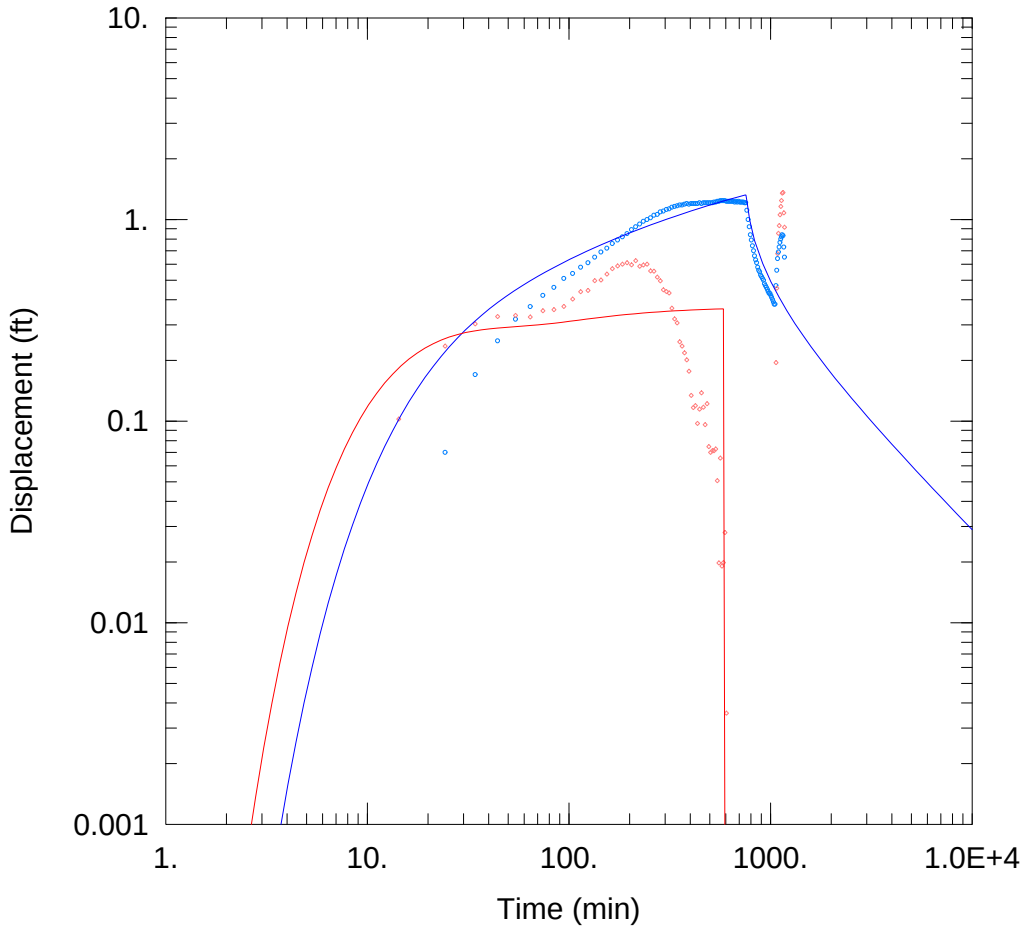
Observation Wells

Well Name	X (ft)	Y (ft)
◦ MW-2S	2106577.52	186411.529

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 1.877E+4 ft^2/day
S = 0.001625
Sy = 0.02032
ß = 0.3207



MW-2I, GWP-10 PUMPING

Data Set: C:\...\MW-2I_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 22:35:15

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

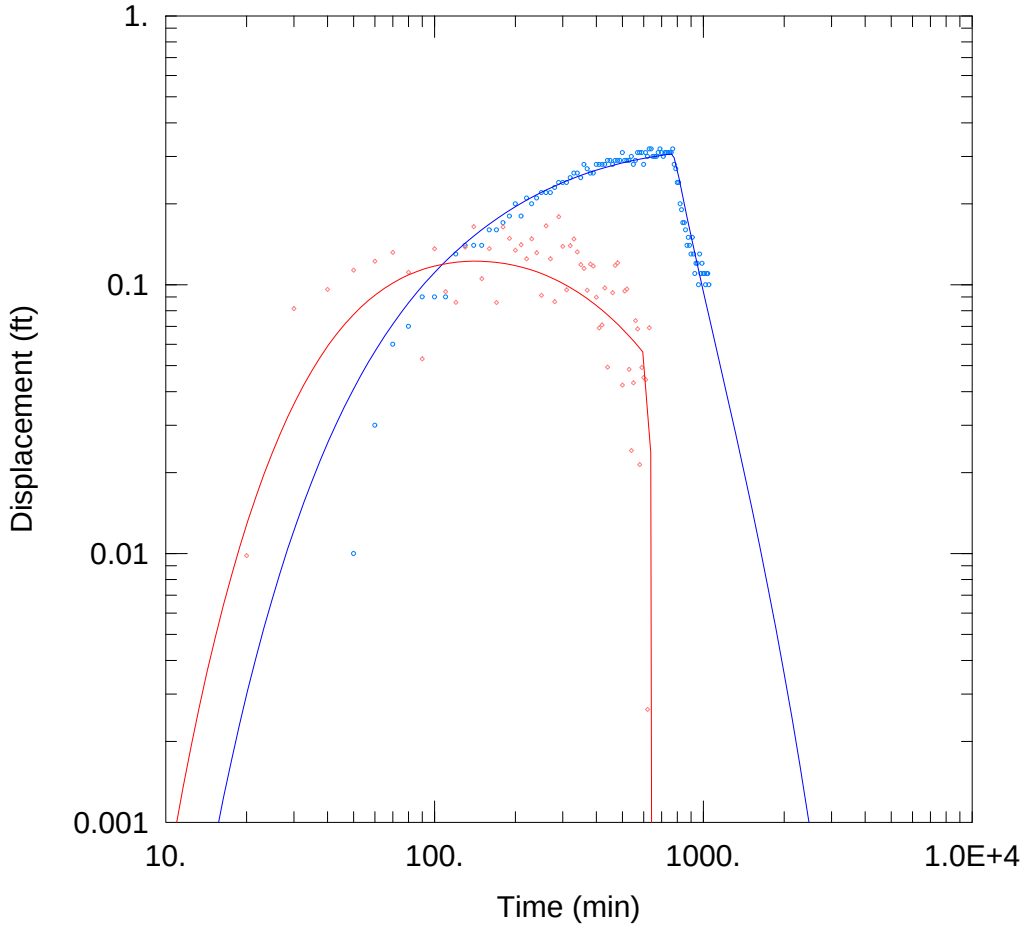
Observation Wells

Well Name	X (ft)	Y (ft)
MW-2I	2106564.0	186423.590

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4.122E+4 ft^2/day
S = 0.001159
r/B = 1.0E-5
Kz/Kr = 0.01
b = 452. ft



SVP-10 PORT 8, GWP-10 PUMPING

Data Set: C:\...\SVP-10-8_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:50:20

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

Observation Wells

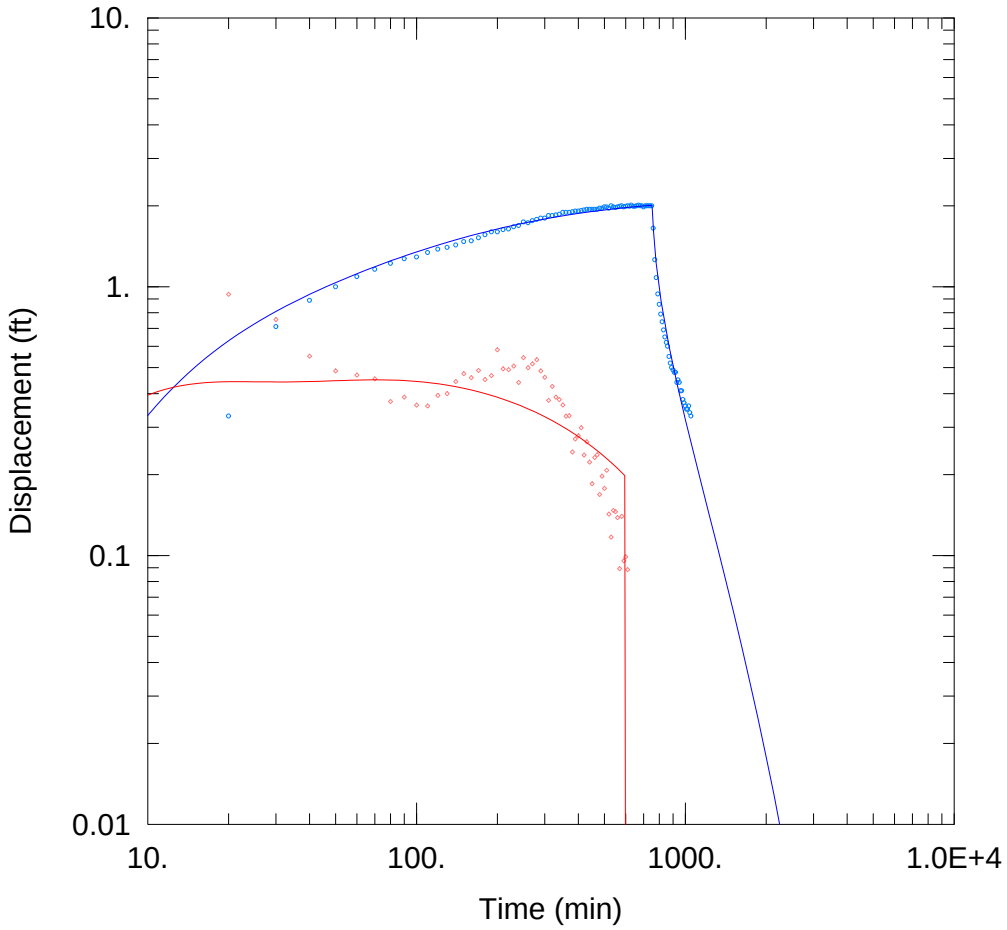
Well Name	X (ft)	Y (ft)
◦ SVP-10-8	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 7.719E+4 ft^2/day
r/B = 0.1866
b = 452. ft

S = 0.002353
Kz/Kr = 0.01



SVP-10 PORT 5, GWP-10 PUMPING

Data Set: C:\...\SVP-10-5_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:34:46

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

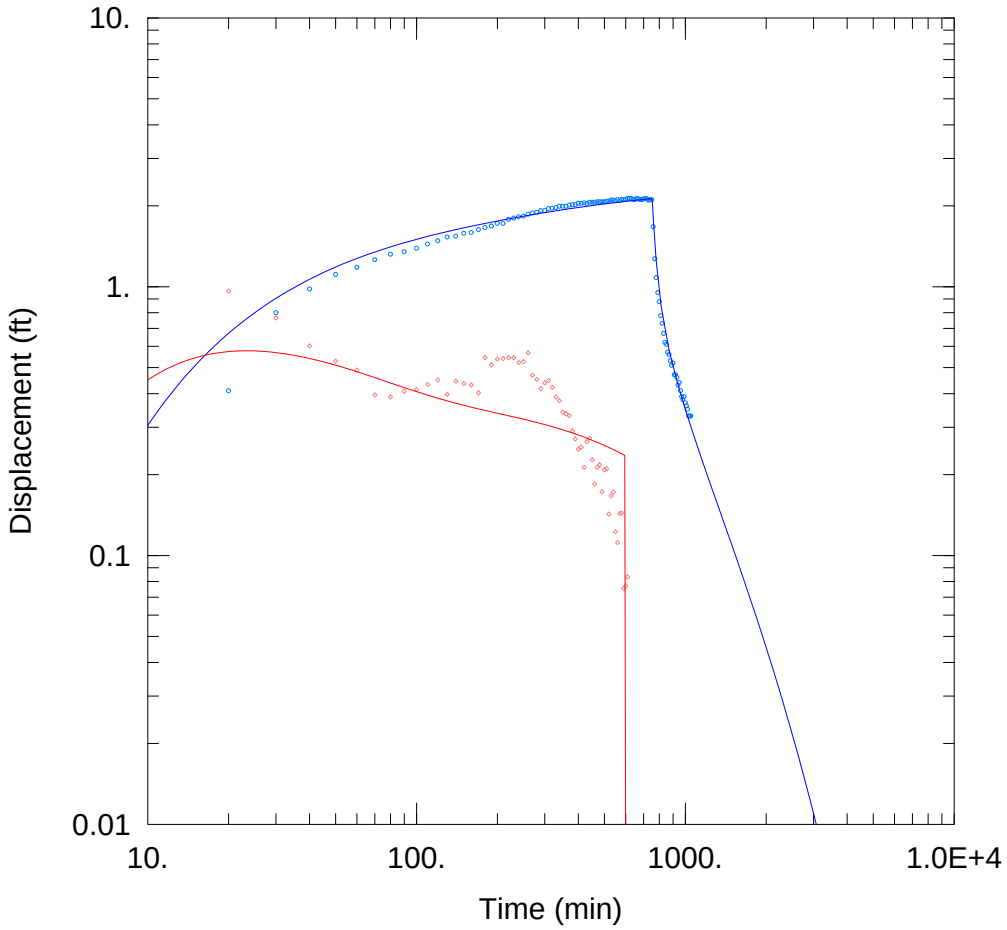
Observation Wells

Well Name	X (ft)	Y (ft)
SVP-10-5	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.756E+4 ft^2/day
S = 0.0003925
r/B = 0.1154
Kz/Kr = 0.01
b = 452. ft



SVP-10 PORT 3, GWP-10 PUMPING

Data Set: C:\...\SVP-10-3_GWP-10_Pumping_HJ.aqt
Date: 06/21/11 Time: 23:32:55

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

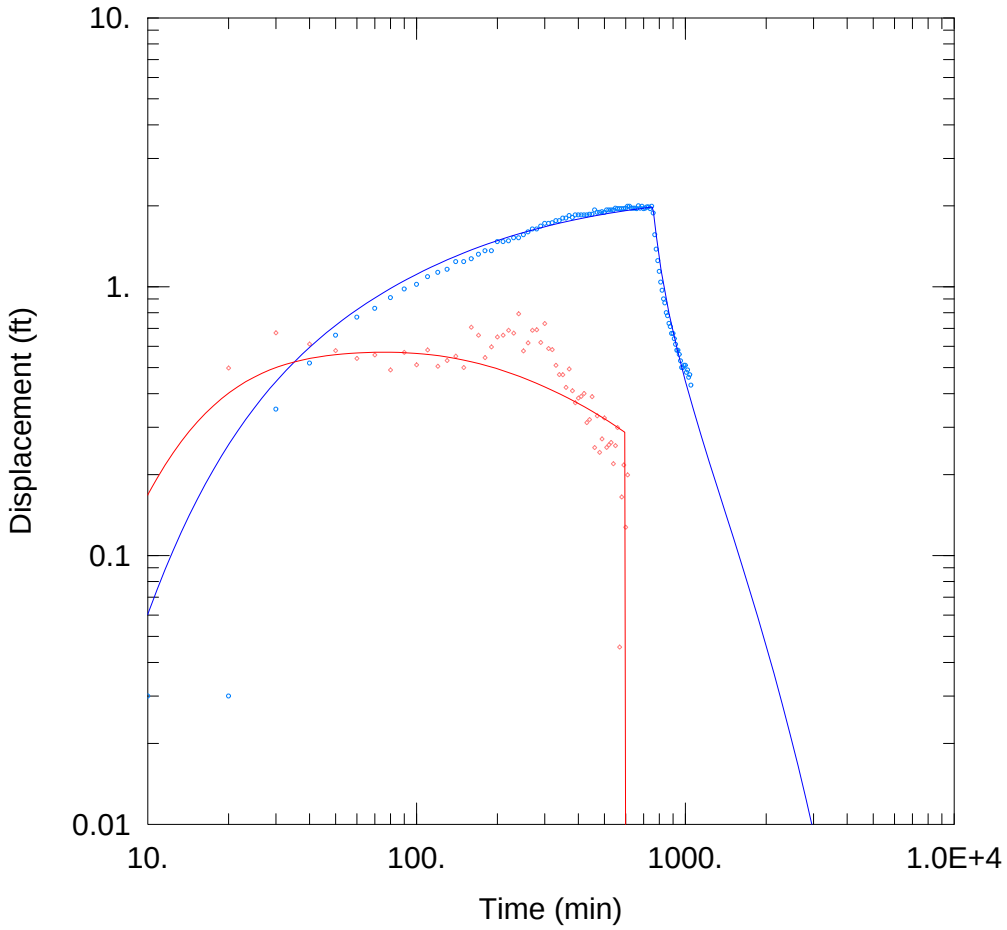
Observation Wells

Well Name	X (ft)	Y (ft)
SVP-10-3	2105899.11	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.702E+4 ft^2/day
S = 0.002155
r/B = 0.1705
Kz/Kr = 0.01
b = 452. ft



SVP-10 PORT 1, GWP-10 PUMPING

Data Set: C:\...\SVP-10-1_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:30:53

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

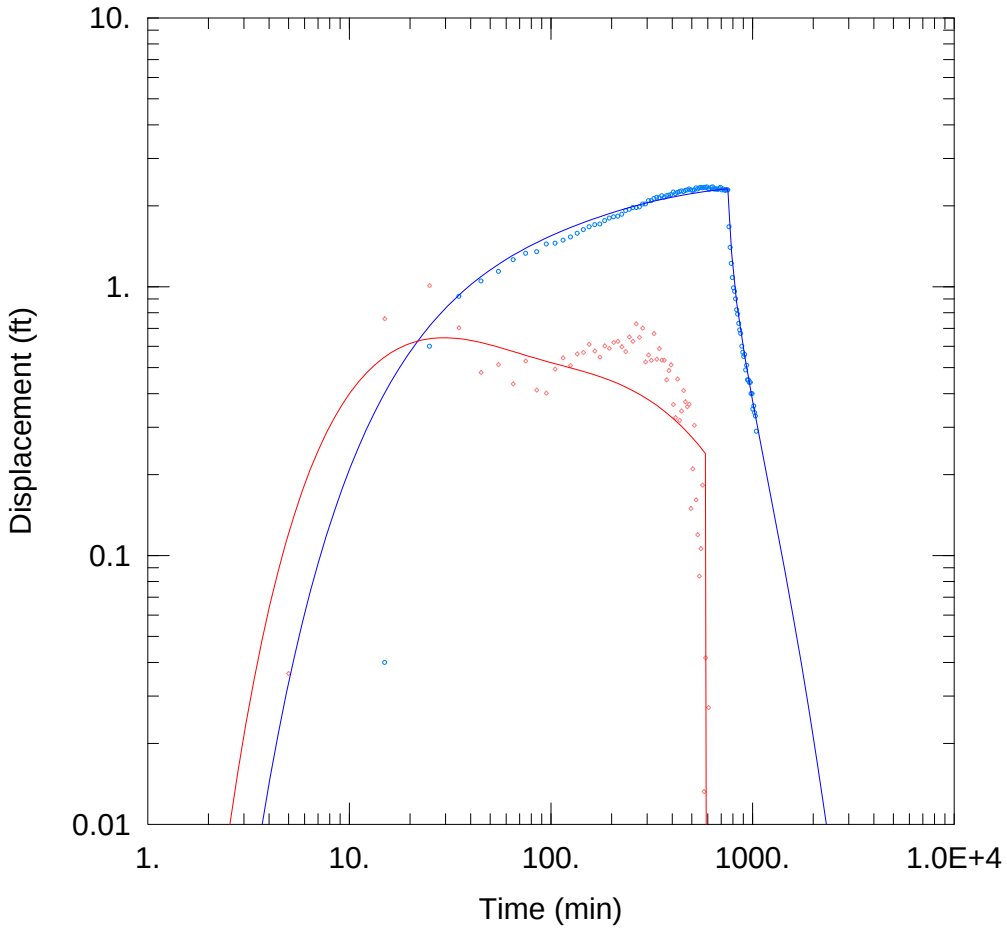
Observation Wells

Well Name	X (ft)	Y (ft)
SVP-10-1	2105899.1	186072.675

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.818E+4 ft^2/day
S = 0.001847
r/B = 0.1966
Kz/Kr = 0.01
b = 452. ft



SVP-11 PORT 2, GWP-10 PUMPING

Data Set: C:\...\SVP-11-2_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:57:44

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: SVP-11-2
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

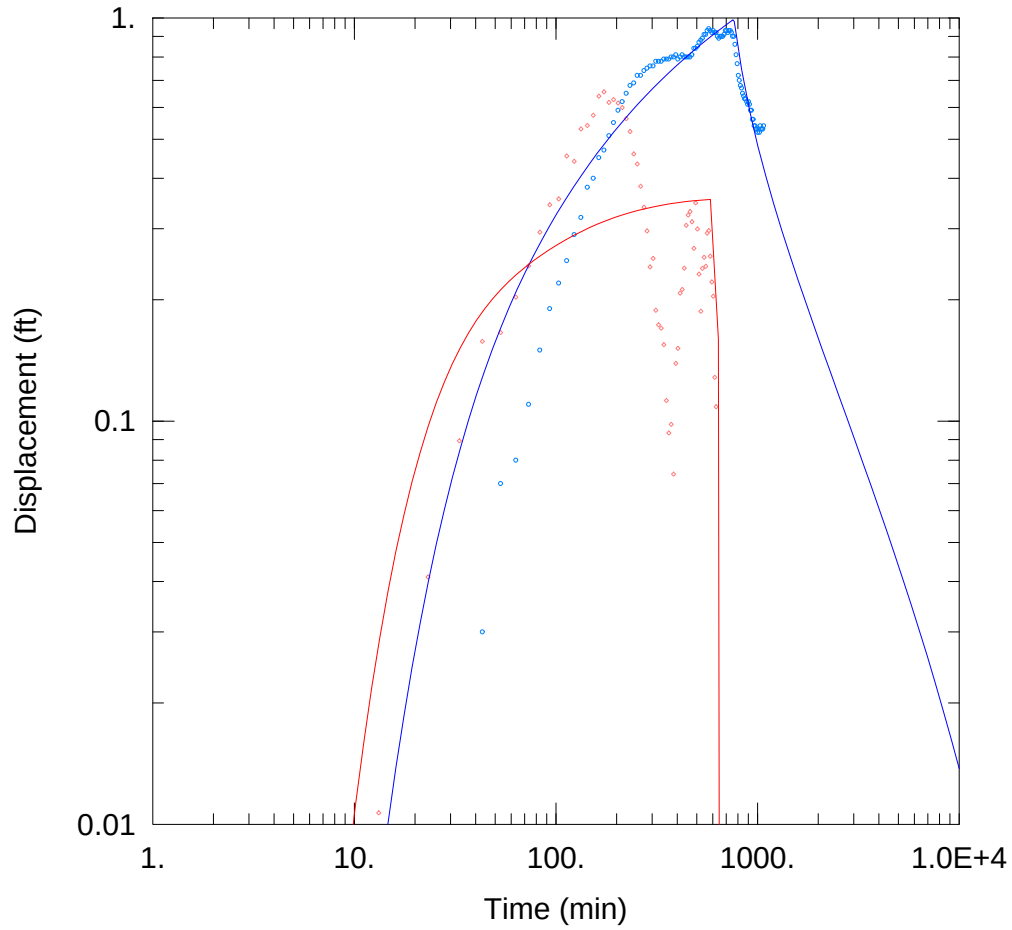
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-11-2	2105597.03	184603.935

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2.28E+4 ft^2/day
S = 0.0008816
r/B = 0.2945
Kz/Kr = 0.01
b = 452. ft



SVP-2 PORT 4, GWP-10 PUMPING

Data Set: C:\...\SVP-2-4_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:03:04

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

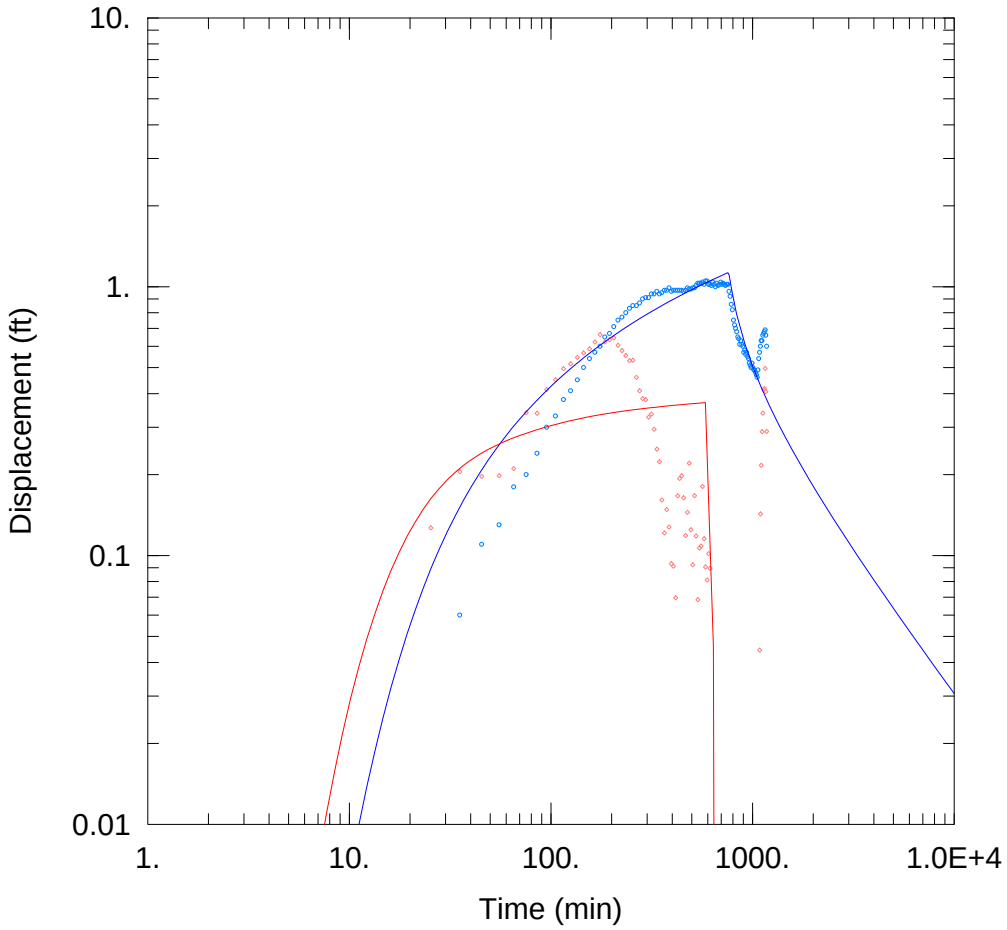
Observation Wells

Well Name	X (ft)	Y (ft)
SVP-2-4	2106214.48	187385.723

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.788E+4 ft^2/day
S = 0.001325
r/B = 0.1276
Kz/Kr = 0.01
b = 452. ft



SVP-3 PORT 3, GWP-10 PUMPING

Data Set: C:\...\SVP-3-3_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:06:12

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

Observation Wells

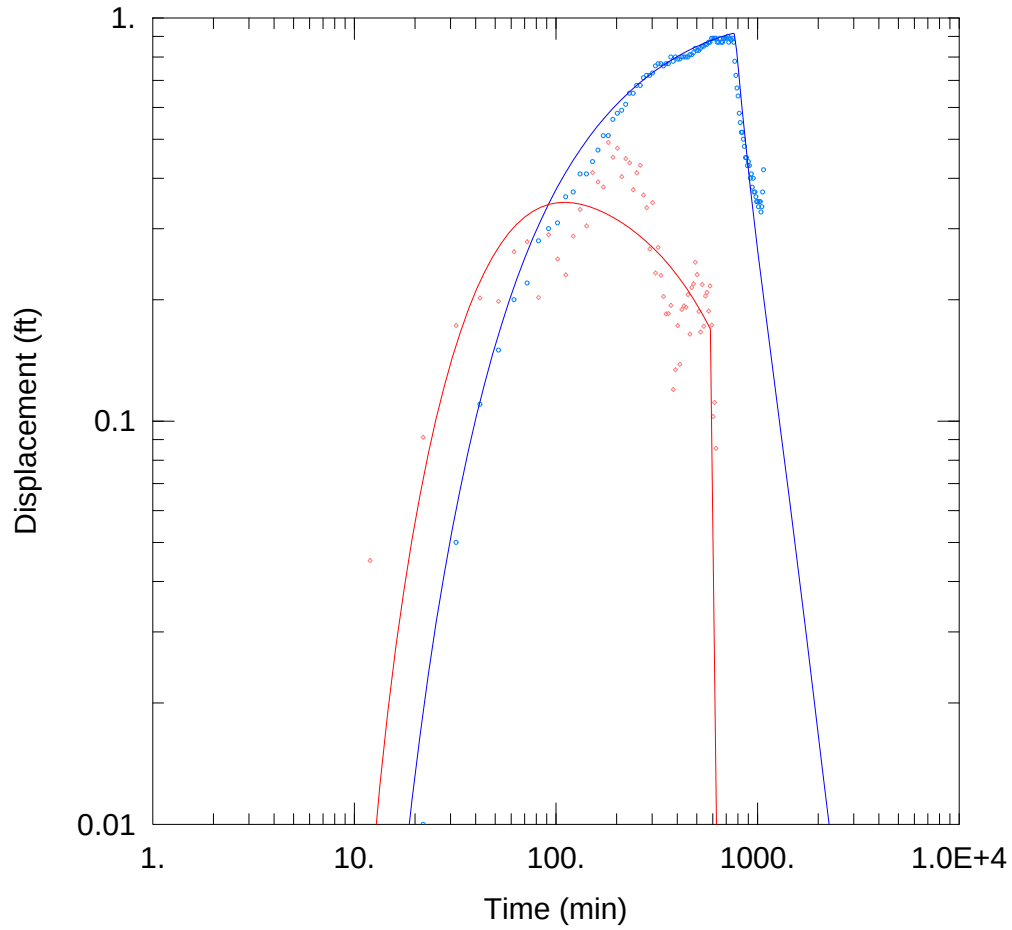
Well Name	X (ft)	Y (ft)
SVP-3-3	2106542.34	186966.005

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.881E+4 ft^2/day
r/B = 1.0E-5
b = 452. ft

S = 0.001368
Kz/Kr = 0.01



SVP-4 PORT 6, GWP-10 PUMPING

Data Set: C:\...\SVP-4-6_GWP-10_Pumping-NU.aqt
Date: 06/26/11 Time: 22:49:30

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

AQUIFER DATA

Saturated Thickness: 452. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

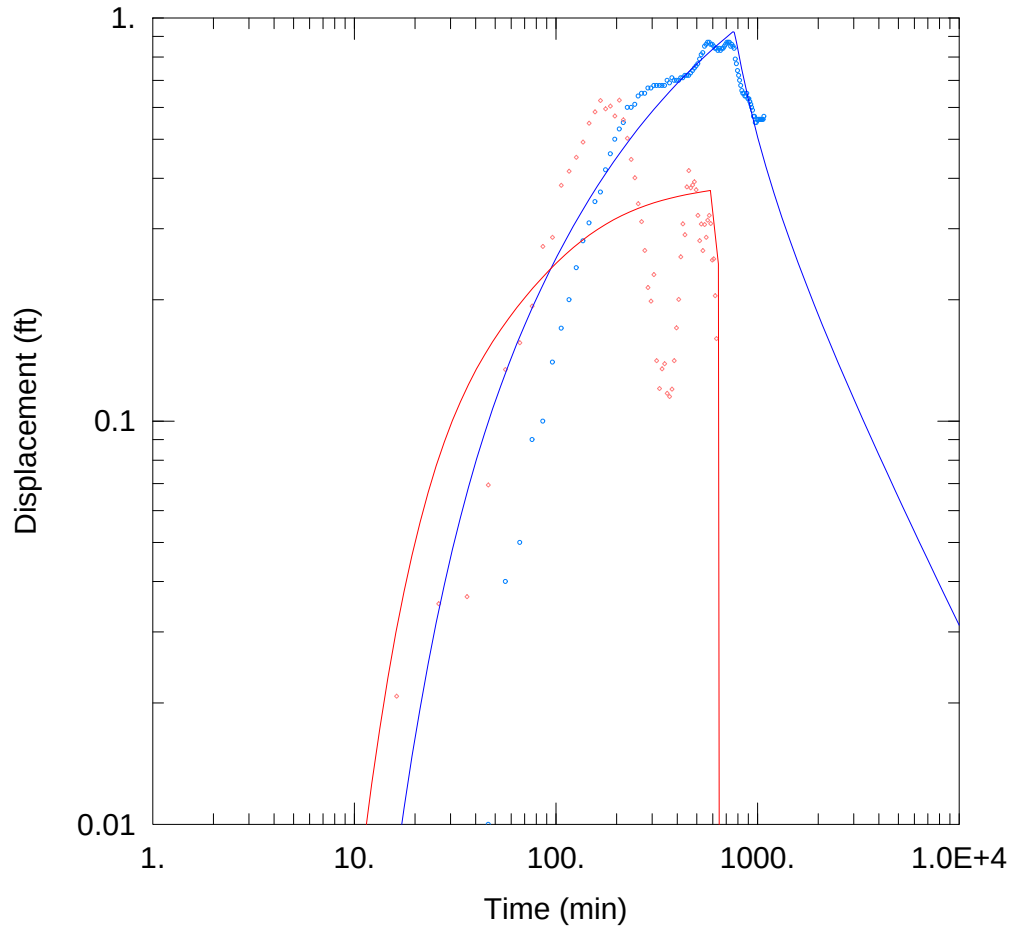
Observation Wells

Well Name	X (ft)	Y (ft)
◦ SVP-4-6	2105820.7(	186882.689

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2.06E+4 ft^2/day
S = 0.001062
Sy = 0.5
ß = 0.1



SVP-9- PORT 5, GWP-10 PUMPING

Data Set: C:\...\SVP-9-5_GWP-10_Pumping-HJ.aqt
Date: 06/21/11 Time: 23:27:28

PROJECT INFORMATION

Company: CDM
Client: U.S. EPA
Project: 3220-023
Location: Garden City, NY
Test Well: GWP-10
Test Date: 9/7/2010

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
GWP-10	2105573	185553

Observation Wells

Well Name	X (ft)	Y (ft)
SVP-9-5	2105956.76	187687.257

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3.814E+4 ft^2/day
S = 0.0009566
r/B = 1.0E-5
Kz/Kr = 0.01
b = 452. ft

Appendix J

Simulation of Aquifer Test and Model Refinement Memorandum

CDM

Memorandum

To: *Project File*

From: *Dan O'Rourke, Karilyn Heisen and Bob Fitzgerald*

Date: *April 13, 2011*

Subject: *Old Roosevelt Field: Simulation of Aquifer Test and Model Refinement*

The 72-hour aquifer test that was conducted at the Old Roosevelt Field (ORF) site in Garden City, New York between September 7-10, 2010 was simulated using the ORF groundwater model (CDM, 2007, 2008). The purpose of the simulation was to check the model's response against groundwater head data collected during the aquifer test. The ORF groundwater model was previously calibrated to measured groundwater head data collected in April and July 2006 and was used to evaluate various alternatives for the Feasibility Study (FS). The development of the groundwater model was documented in a technical memorandum dated August 13, 2007, which also serves as Appendix A of the Feasibility Study (FS).

The Record of Decision (ROD) calls for a pump and treat system to remediate a portion of the TCE and PCE plume upgradient of the existing community water supply wells owned and operated by Garden City Water District (Wells 10 and 11). In 2008, the ORF groundwater model was used to site an extraction well system to capture the 100 ppb portion of the plume, while minimizing impacts to head at the Garden City wells, while siting the wells within the property constraints at the time (e.g., within the parking lot). Due to the thickness of the plume, a three well system was recommended, consisting of 50-60 foot screen intervals and spanning a depth from 210 to 410 feet below grade. The total extraction rate was simulated at 250 gpm in which 70 gpm was pumped from the shallow and intermediate wells and 110 gpm was pumped from the deep recovery well.

In the summer of 2010, the extraction well system was installed and an aquifer test was conducted. In addition to the installation of the extraction wells, additional multi-port monitoring wells were installed since the last round of groundwater modeling. Two of these wells were installed within the immediate vicinity of the aquifer test and Garden City supply wells, SVP-10 (located immediately adjacent to the extraction wells) and SVP-11 (just downgradient of the Garden City supply wells). Groundwater head data were collected at these and several other wells within the vicinity (**Figure 1**, **Table 1**).

Table 1
Wells Monitored for Groundwater Head during 72 Hour Aquifer Test

Monitoring Well	Intervals Monitored (depth, ft)
SVP-02	Port 4 (330-335)
SVP-03	Port 3 (370-375)
SVP-04	Port 6 (245-250)
SVP-09	Port 5 (285-290)
SVP-10	Port 1 (480-485), Port 3 (350-355), Port 5 (285-290), Port 8 (145-150), Port 10 (45-50)
SVP-11	Port 2 (400-405)
MW-01	MW-01i (305-315), MW-01s (235-245)
MW-02	MW-02i (306-316), MW-02s (236-246)
MW-03	MW-03i (304-314), MW-03s (234-244)
N-10019	223-228
N-10020	186-191
EW-01 (extraction well)	EW-01d (350-410), EW-01i (280-340), EW-01s (210-260)

Reference:
Average surface elevation from wells listed above (and Garden City Supply Wells) = 86.6 ft, msl
Garden City Well 10 screen interval = 377-417 feet below grade
Garden City Well 11 screen interval = 370-410 feet below grade

Groundwater Model Simulations

Supply Well Pumping Rates

The objective of the groundwater model simulations was to reproduce observed changes in head from the aquifer test at the various monitoring points. Although actual groundwater supply pumping data was collected at several times for Garden City Well 11 (N-03935) during the aquifer test, it was only estimated at Well 10, as the flow meter was not functional for that well. Estimates were made based on personal communication with the operators from Garden City and operation durations were assumed based on head responses during the test. Well 11 was pumping continuously throughout the duration of the test while Well 10 was generally operated from the early morning hours into the mid-afternoon and again for a brief period in the late evening.

There are numerous groundwater supply wells that surround the site operated by several different water purveyors. Detailed (hourly) pumping data were not available for those wells during the aquifer test. Regional groundwater supply pumping rates were also not available for 2010 at the time of this analysis.

Since 2010 groundwater pumpage data were not available for all wells, the transient groundwater model utilized for the FS and the subsequent design was used for the aquifer test analysis (average pumping and recharge from 2002-2007). Although average pumping and recharge conditions were used regionally, pumping at Garden City wells 10 and 11 was updated to observed conditions during the aquifer test (including pre and post test). However, because average conditions were used

regionally, the actual groundwater head data collected from the monitoring wells was not a calibration target. Rather, the calibration target was observed change in head, which in a sense is independent of actual head (e.g., if a 2 foot decrease in head in a well is observed with starting head at 53 feet, msl and a 2 foot head decline is simulated at a starting head of 55 ft, msl, the model is accurately simulating the aquifer's response to the pumping stress).

Time steps prior, during and after the pump test were reduced to 30 minutes. The pump test was initiated at 10:30 AM on 9/7/2010 and ended on 9/10/2010 at 10:30 AM. The model simulation was run from 12:00 AM on 9/5/2010 until 9/11/2010. Although the actual aquifer test from EW-01 was run for a 72 hour period, groundwater head within the study area is strongly influenced by the operation of the Garden City supply wells. Therefore, evaluating observed head prior to the start of the aquifer test and comparing that to simulated values is essentially a shorter term, cyclic aquifer test.

Stratigraphic Adjustments

Stratigraphy was adjusted to include a coarser zone within the middle Magothy, based on a gamma logging conducted at SVP-10 and a boring log that was developed from split spoon samples collected from the test well installation (**Figures 2 and 3**). With the additional data, correlations with previously collected boring logs enables the vertical extent of this zone to be somewhat defined, although the western extent is unknown due to a lack of geologic data west of Clinton Road. The hydrogeologic properties within the model were adjusted within the study area. A summary of hydrogeologic changes is summarized on **Table 2**.

Simulation Results

Model simulation results are shown on **Figures 4-12** (ordered in general proximity to EW-01 with SVP-10 being the closest and SVP-11 the furthest). The figures are displayed so that the initial response using the calibrated model from the FS is at the top of the figure, followed by two versions of hydraulic conductivity of the sandy zone which was incorporated into the model.

The initial focus of the model calibration was to SVP-10, as this well had numerous ports which were frequently monitored using pressure transducers and is closest to the extraction well (**Figures 4a,4b**). As shown on **Figures 4a and 4b**, the model simulates too much head decline in most of the observed ports using the original hydrogeologic properties from the calibrated model. The model provides a very close match to observed groundwater head in port 5 prior to the aquifer test, but simulates too much decrease in head in that port during the aquifer test. The model simulated too much head decline in all other ports both prior to and during the aquifer test.

In order to address the excessive simulated head decline, the sandy zone that was incorporated into the model was coarsened, as well as some other adjustments (see figures). The middle and bottom set of figures show two versions of this zone, one with a horizontal conductivity (Kh) of 80 ft/day (middle) and one with a relative very high Kh for the Magothy aquifer of 180 ft/day (bottom). Note

Table 2
Wells Monitored for Groundwater Head during 72 Hour Aquifer Test

Hydrogeologic Parameter		Original (FS model)	Adjusted
Upper Magothy	Kh (ft/day)	35	60
	Kv (ft/day)	0.6	0.6
	Sy	0.25	0.15
	Ss (ft^{-1})	1×10^{-6}	2×10^{-6}
Middle Magothy	Kh (ft/day)	40	40
	Kv (ft/day)	0.7	0.7
	Sy	0.25	0.15
	Ss (ft^{-1})	1×10^{-6}	2×10^{-6}
Middle Magothy (coarse zone)	Kh (ft/day)	N/A	80 – 180[1]
	Kv (ft/day)		2.0
	Sy		0.15
	Ss (ft^{-1})		2×10^{-6}
Basal Magothy	Kh (ft/day)	60	80
	Kv (ft/day)	1.2	1.2
	Sy	0.25	0.15
	Ss (ft^{-1})	1×10^{-6}	2×10^{-6}
Raritan Clay	Kh (ft/day)	0.3	0.3
	Kv (ft/day)	8×10^{-4}	1×10^{-4}
	Sy	0.25	0.25
	Ss (ft^{-1})	1×10^{-5}	1×10^{-5}

Note: two simulations were utilized in this evaluation, one using 80 ft/day for the coarser zone and a second using 180 ft/day. Kh = horizontal hydraulic conductivity and Kv = vertical hydraulic conductivity.

that the very high conductivity of 180 ft/day appears to provide the closest match to observed head for all ports of SVP-10, although the simulated response in ports 1 and 5 are better during the background period using a Kh of 80 ft/day.

The results of the aquifer test revealed a complex sequence in which changes in hydraulic conductivity did not have the same effect prior to and during the aquifer test. This is evident by the simulated response of port 5 in SVP-10. In order to match the observed head decline during the aquifer test, the sandy zone within the middle Magothy had to be coarsened to represent a simulated horizontal hydraulic conductivity of 180 ft/day. However, in doing that, the difference between the simulated head change and observed head change during the background period was somewhat increased. Furthermore, the Magothy aquifer generally fines upwards, in which the coarsest zone is within the basal Magothy, representing a high energy environment of deposition. Although it is certainly possible for a coarser zone to be within the middle Magothy, having that zone be more than double the Kh of the basal Magothy is questionable (nor is a coarse sand or gravelly zone noted in the boring logs, but rather fine to medium sand). Furthermore, having this very high horizontal conductivity zone doesn't seem to have a significant improvement on heads at most of the other monitoring wells included in

this analysis. Nevertheless, in order to match the head decline at SVP-10, a relatively very high hydraulic conductivity is required in the model. It is quite possible that this zone is very localized and although a more sandy zone appears to extend throughout the area in the middle Magothy, the hydraulic conductivity of this zone throughout the study area may in fact be closer to the 40-80 ft/day as shown in the top and middle figures. In general, although the higher Kh of 180 ft/d provides a better match to observed data at SVP-10, in some cases there is no significant difference in simulated response between the three variations (particularly for those monitoring points which are further away from the wells).

The head response in other monitoring wells is dominated by the operation of Garden City water supply Well 10 and head responses to the extraction well are masked by its operation. Therefore, the model head responses from surrounding monitoring wells focused on the pre-test pumping period (**Figures 5-12**). Due to the significant influence from the Garden City supply wells, the model target was focused on the pre-test period for wells other than SVP-10.

Further complicating the aquifer test is an interesting phenomenon that is apparent with several of the monitored wells in which the simulated head response prior to the aquifer test is in very good agreement with observed head, but somewhat off during the aquifer test. In many instances, the observed head slowly increases and then increases rapidly (this rapid increase is assumed to be due to Well 10 turning off). It is possible that this initial slow increase is in response to a lower pumping rate at Well 10, which is not reflected in the model. When this initial response is not included in the analysis and simulated head change is measured from a later time (when head is similar to the start of the aquifer test, approximately 5 hours after the start of the test), the simulated response is in much better agreement to the observed response. An example of this is shown on **Figure 13** for SVP-04, for the condition in which the sandy zone incorporated into the middle Magothy has a horizontal hydraulic conductivity of 80 ft/d. Head at SVP-04 was monitored from Port 6, which is above the newly incorporated sandy zone.

Discussion

The aquifer test at the Old Roosevelt Field site involved a significant amount of complexity in which heads were strongly influenced by the municipal supply wells. The extent to which heads were influenced by other wells (other than Garden City wells 10 and 11 and the extraction well), is somewhat unclear, particularly to wells that are further from the extraction well and the two Garden City wells. For example, as shown on **Figure 11**, the simulated and observed head changes for port 5 in SVP-09 indicate a reasonable match between simulated and observed head changes during the first cycle of the background period, however, the observed decrease in head is much higher than simulated during the early morning hours of 9/7/10. It is possible that surrounding water supply wells (non-Garden City) are influencing head in SVP-09 since additional head decline is observed. Surrounding wells may have been pumped at capacity for a period of time and these increased pumping rates at non-Garden City wells are not included in the model as pumping rates and duration data were not available. Further supporting this possibility is the sharp increase in head at the start of

the aquifer test, which may be an indication of one or more of these surrounding wells being shut down.

A calibration check was also conducted, comparing simulations run under the various hydraulic conductivities to observed head in April and July of 2006. For most observation wells, a better match between simulated and observed head was observed with an increase in the transmissivity of the middle portion of the Magothy aquifer. However, the extent to which this increase exists and to what degree remains uncertain. However, model simulations show a reasonable correlation with observed head change at several wells by increasing the horizontal hydraulic conductivity in a sandy zone to 80 ft/d.

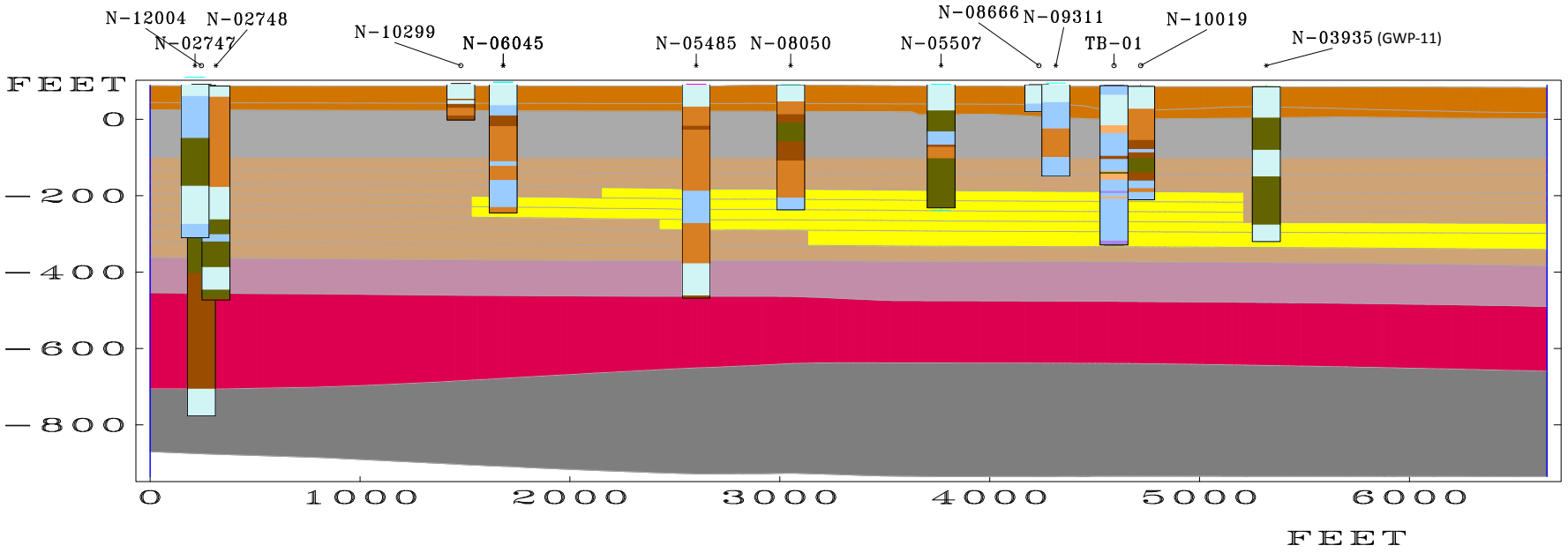
Only a few monitoring points show a better correlation with observed head decline using a much higher horizontal hydraulic conductivity of 180 ft/day. There was no significant difference in simulated vs observed head between the original model and incorporating this much more transmissive zone, likely due to the somewhat limited extent to which the sandy zone was incorporated and the regional influence on groundwater head. Overall, however, simulated heads at the SVP wells were in somewhat better agreement with observed heads from the original calibration period (April and July 2006) by incorporating the coarser sandy zone within the middle Magothy.

The simulated 15 year groundwater contributing areas to EW-01 are shown on **Figures 14-16** for the original FS model properties as well as the two variations in the sandy zone which was incorporated during this analysis. Simulated pumping rates are 70 gpm in the shallow and intermediate extraction wells and 110 gpm in the deep extraction well, totaling 250 gpm. The simulated capture zone using the higher Kh for the sandy portion of the middle Magothy is somewhat more narrow than the other capture zones and extends slightly further north.

It's important to note that the original design and pumping rates were based on the areal and vertical extent of the TCE/PCE plumes in 2007. It is recommended that an updated plume extent be developed and pumping rates modified accordingly. Should the plume be much deeper than originally depicted, a deeper recovery well may be necessary to achieve capture. In addition, should there no longer be a significant shallow portion of the plume, it's possible that the shallow well may not be needed. **Figure 17** shows the simulated capture zones resulting from pumping the intermediate and deep extraction wells only, at 125 gpm each, respectively. As shown on the figure, a larger portion of the three zones is captured by these two wells. However, if a shallow portion of the plume still exists, then the shallow extraction well will be necessary.

cc: J. Dougherty (CDM)

Figure 1
Wells
Old Roosevelt Field Contaminated Groundwater Site
Nassau County, New York
CDM



- Upper Glacial Aquifer
- Upper Magothy
- Middle Magothy
- Basal Magothy
- Raritan Clay
- Lloyd Aquifer
- Sandy Layer Incorporated into the Middle Magothy

WELL LOG LEGEND

- Silt
- Silt/Sand
- Sand
- Clay
- Sand/Clay
- Clay/Sand
- Sand/Gravel

Projected 200 feet

CROSS SECTION CC

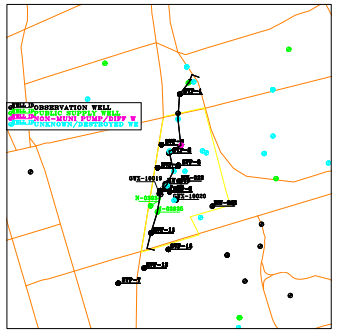


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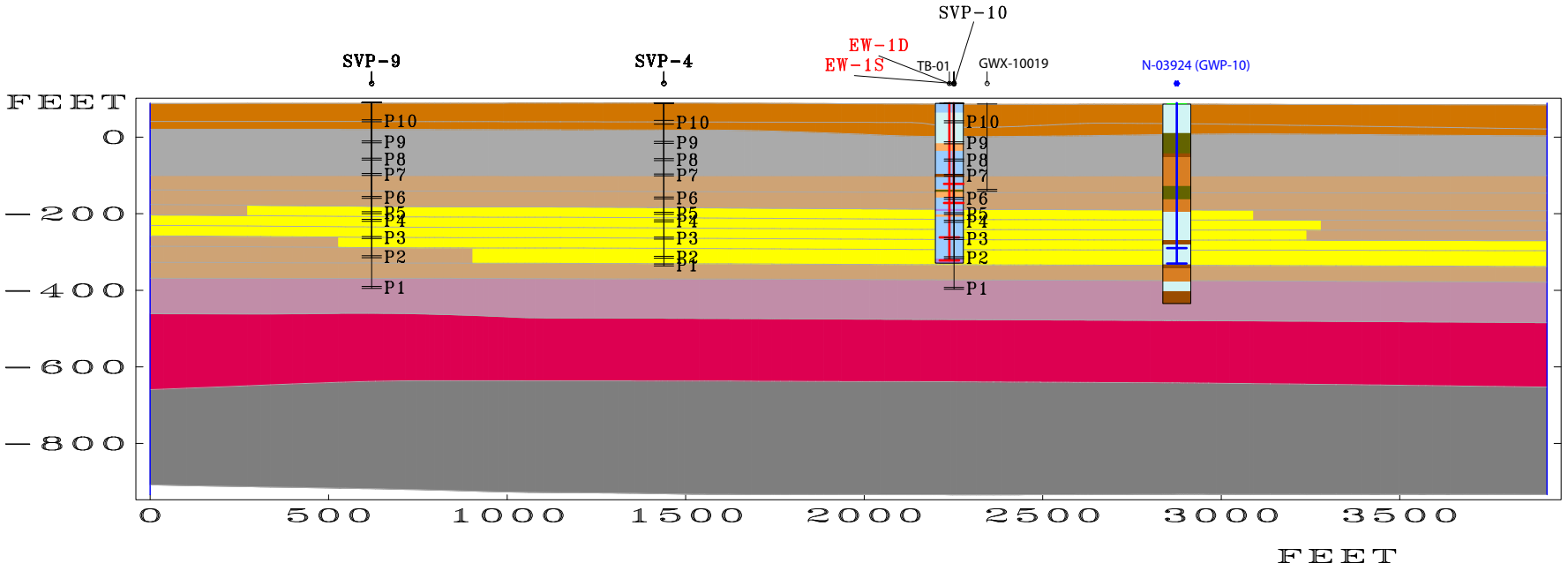
Figure 2
Old Roosevelt Field Groundwater Model
Northeast-Southwest Cross Section

CDM



Upper Glacial Aquifer
Upper Magothy
Middle Magothy
Basal Magothy
Raritan Clay
Lloyd Aquifer

Sandy Layer Incorporated into the Middle Magothy

WELL LOG LEGEND

- Silt
- Silt/Sand
- Sand
- Clay/Sand
- Clay
- Sand/Clay
- Sand/Gravel

Well ID

GROUND SURFACE

TOP OF SCREEN

BOTTOM OF SCREEN

PROJECTED 100 FT

CROSS SECTION DD

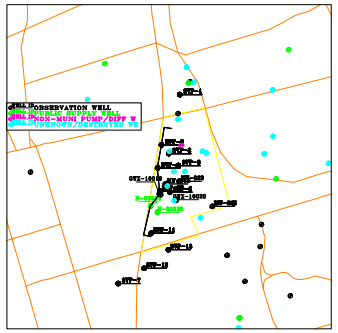
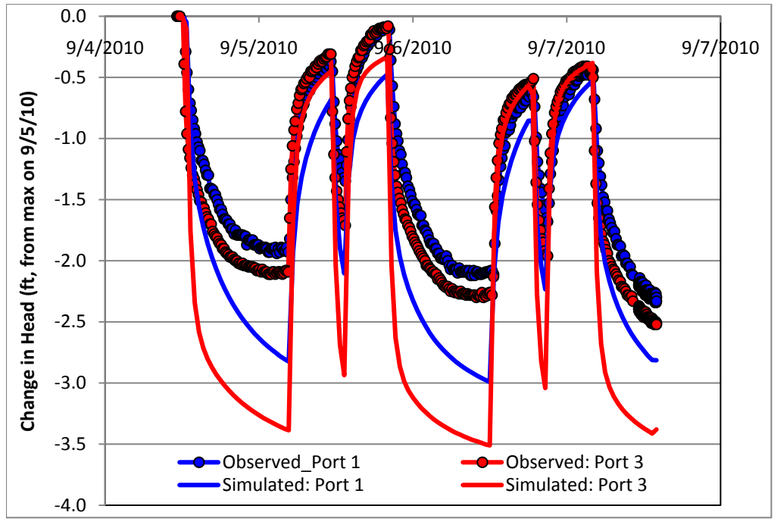
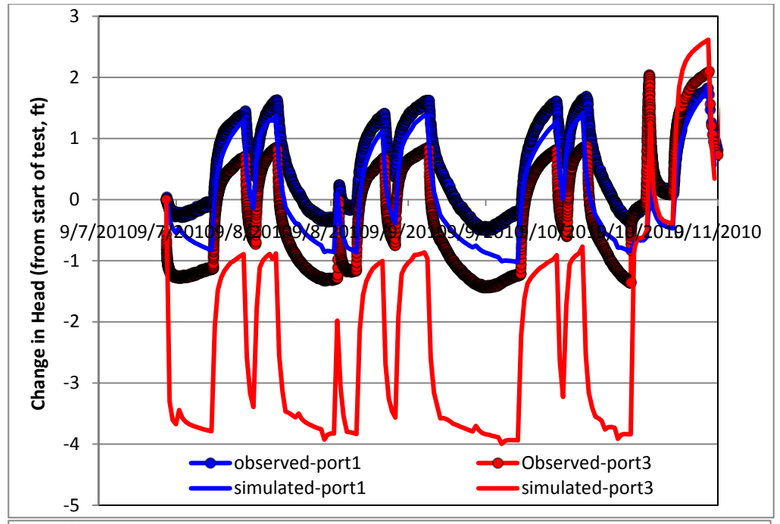


Figure 3
Old Roosevelt Field Groundwater Model
Northeast-Southwest Cross Section

CDM





Original Properties from calibrated model
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MM = 40/0.7 fpd
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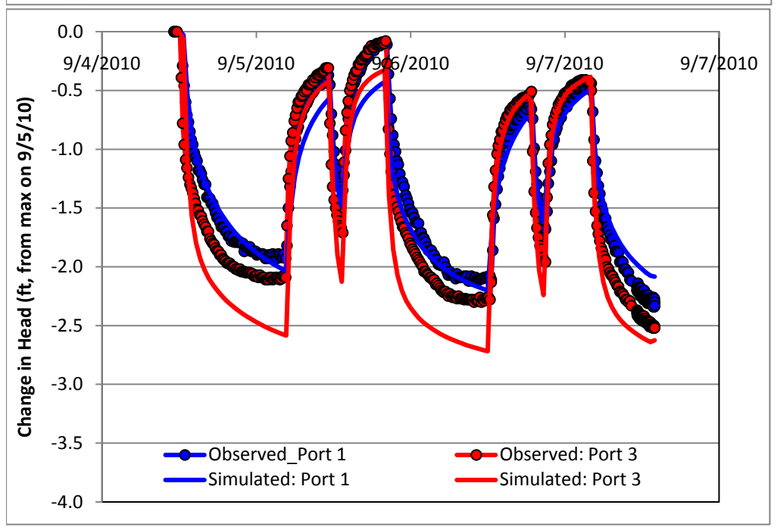
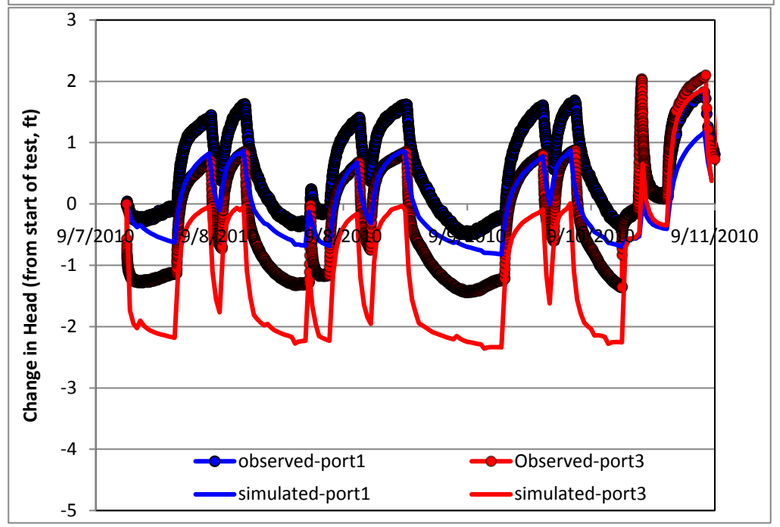
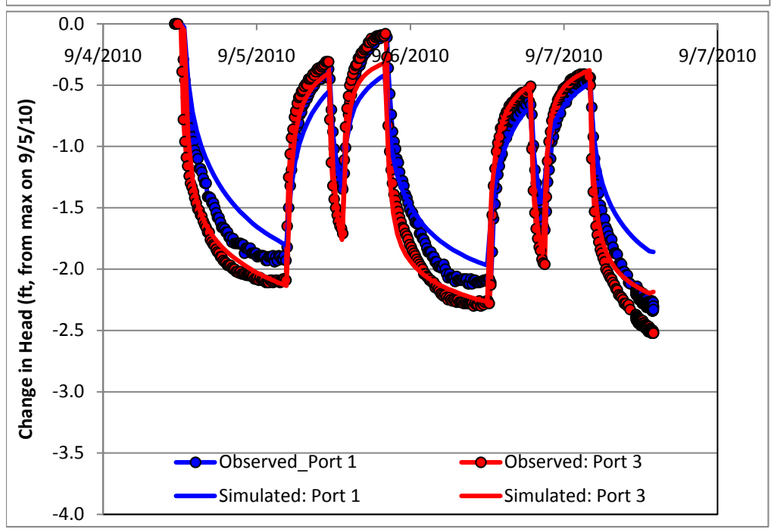
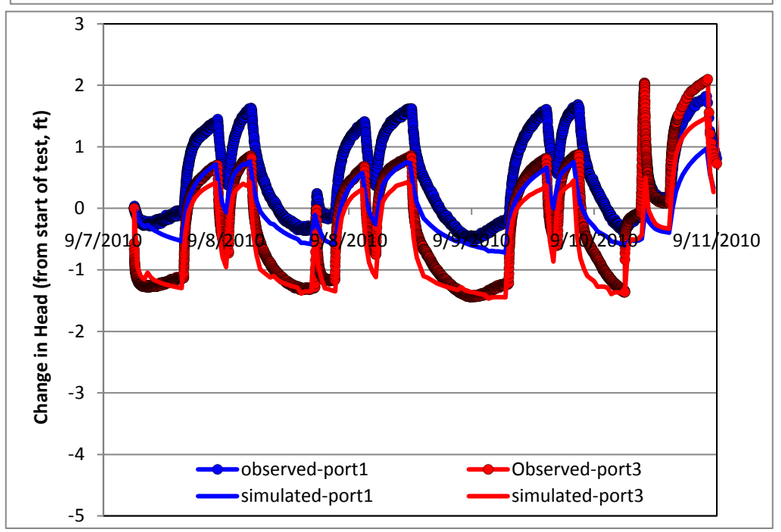




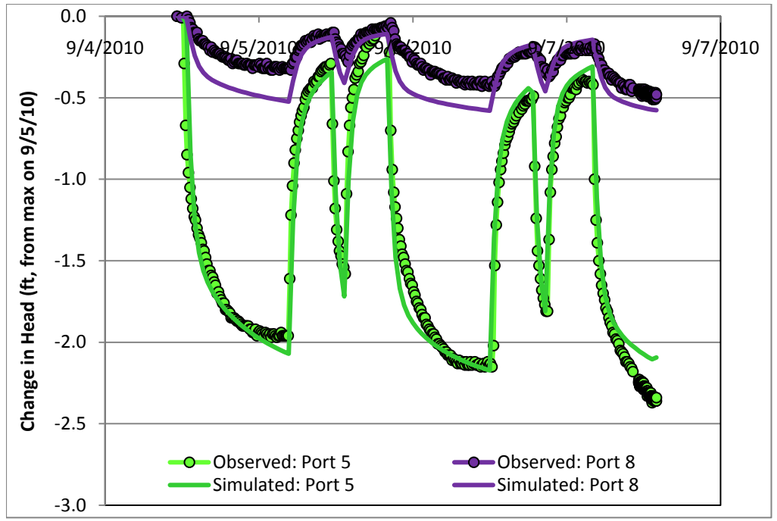
Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

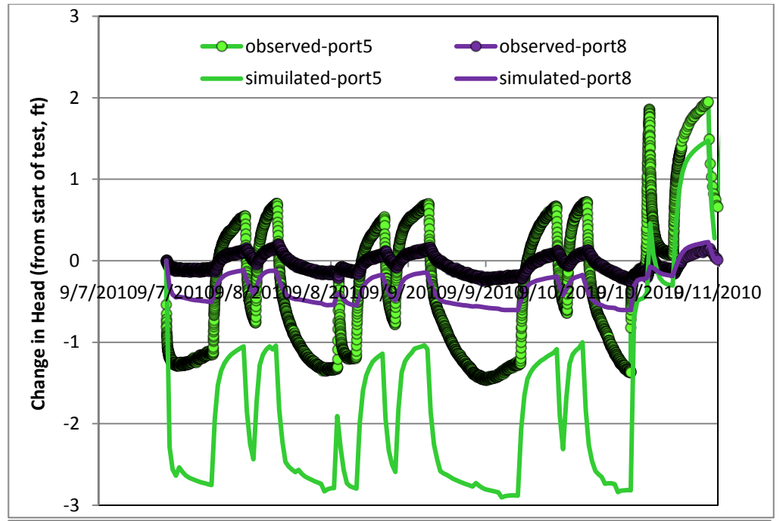




Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 4a Simulated vs. observed head in SVP-10. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).





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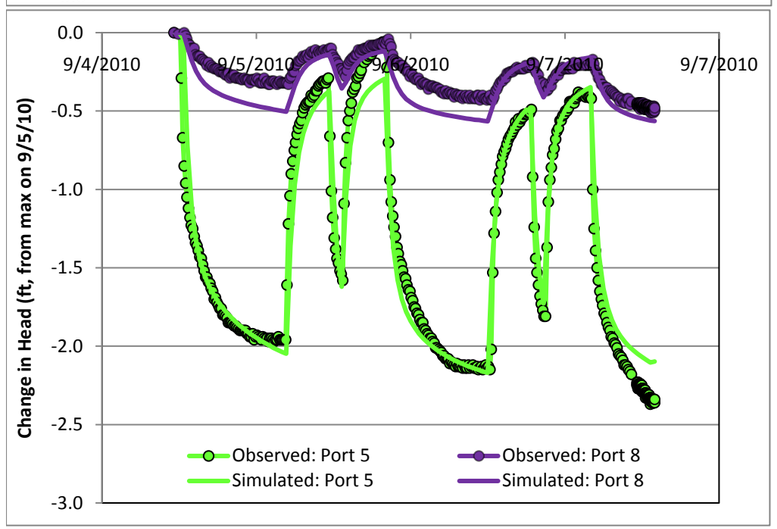
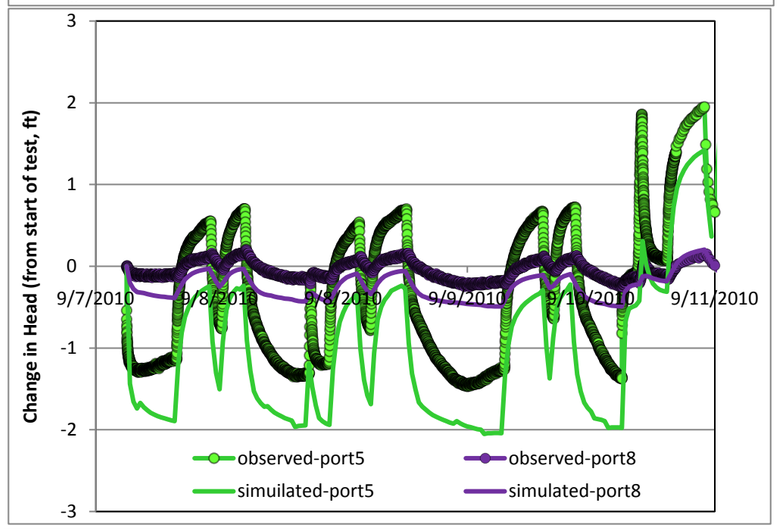
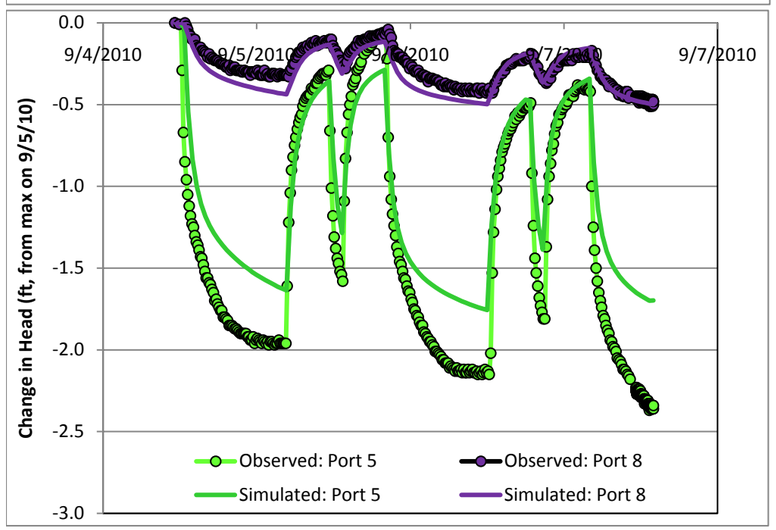
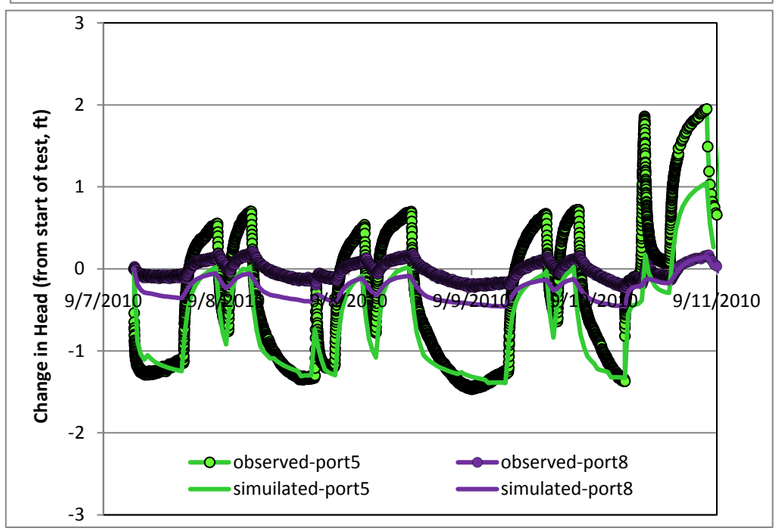




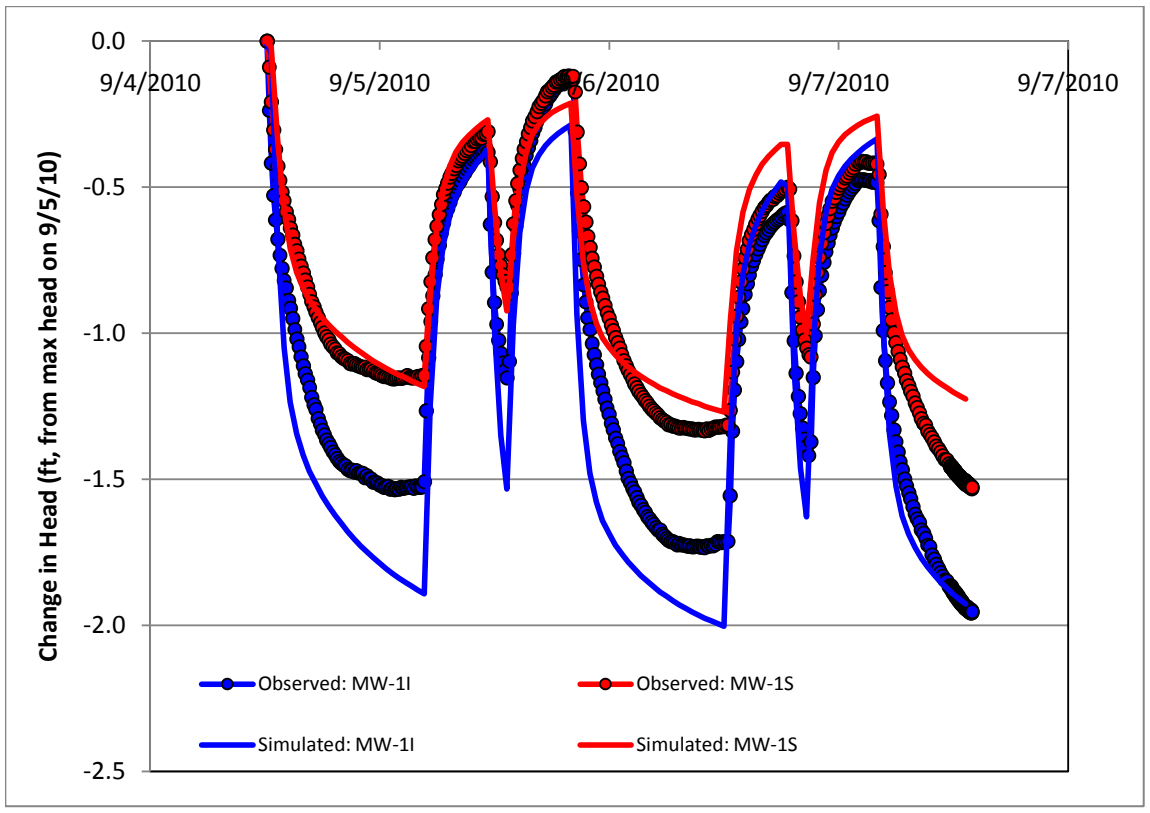
Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d





Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 4b Simulated vs. observed head in SVP-10. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



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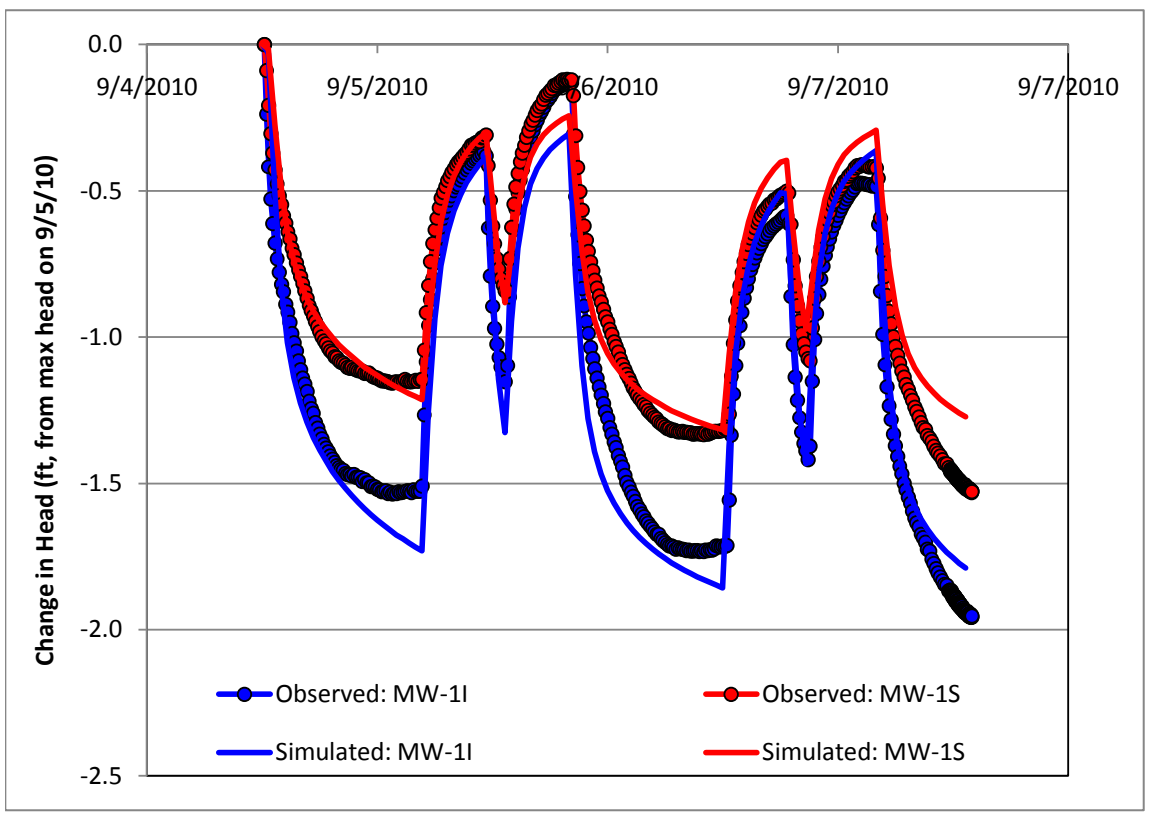

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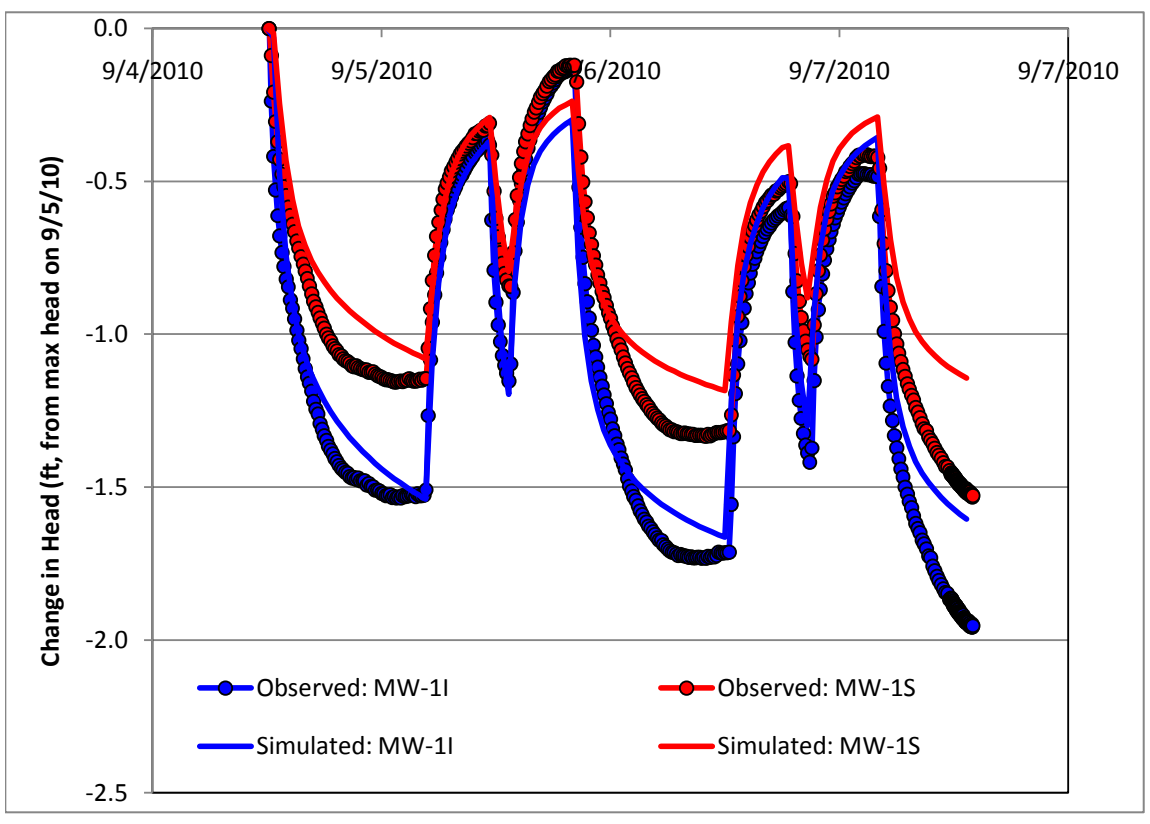
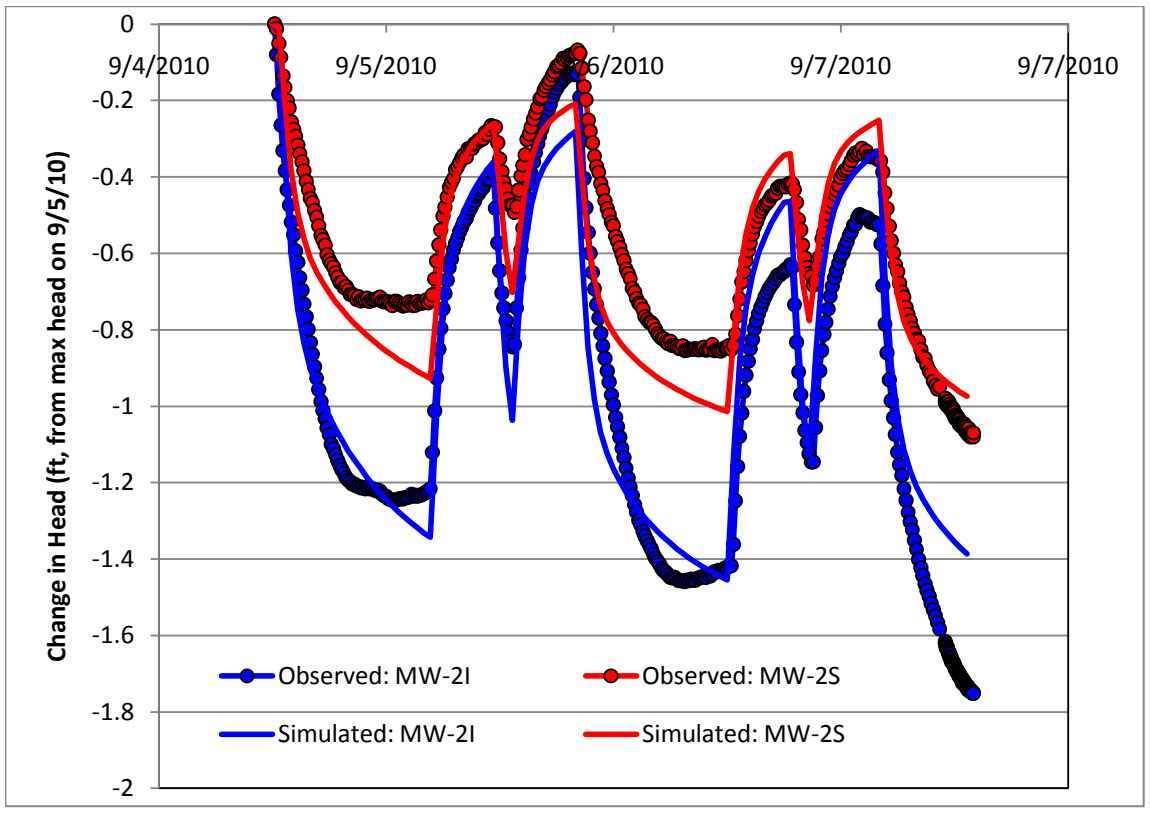
UM = Kh = 60 ft/d



Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 5 Simulated vs. observed head in MW-01. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



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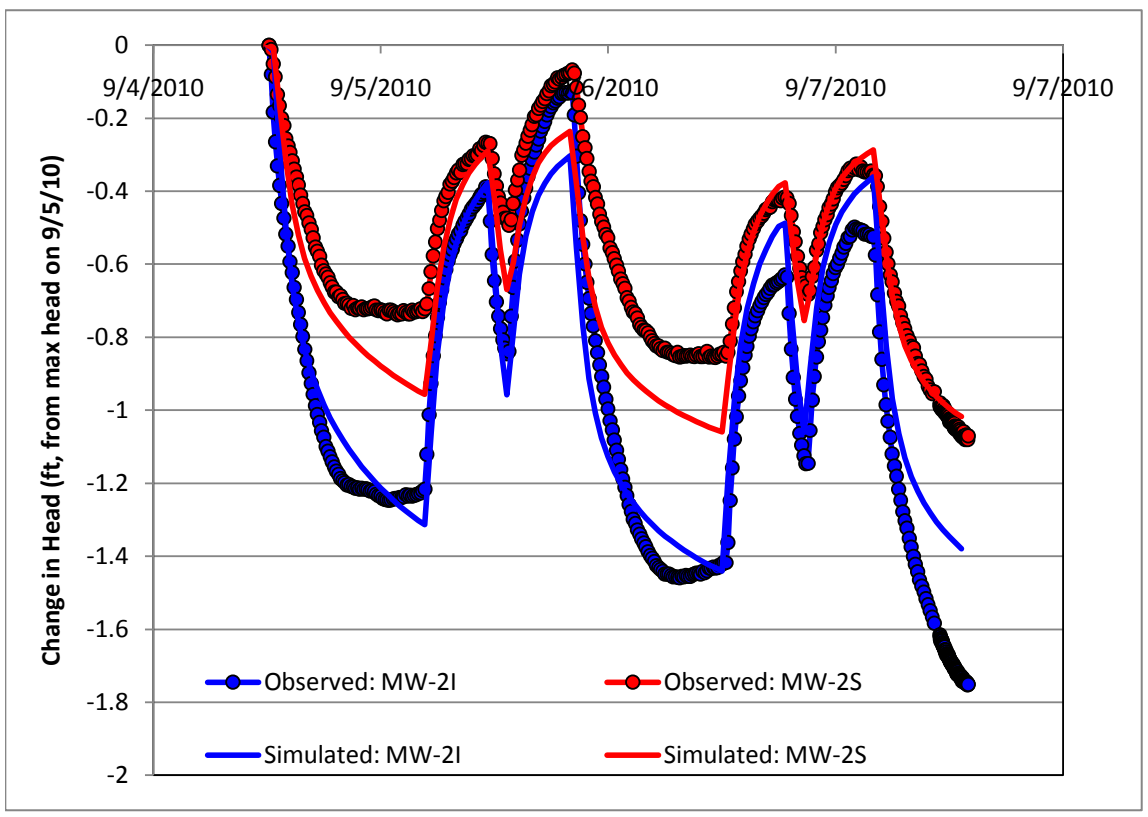

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modified storage properties slightly
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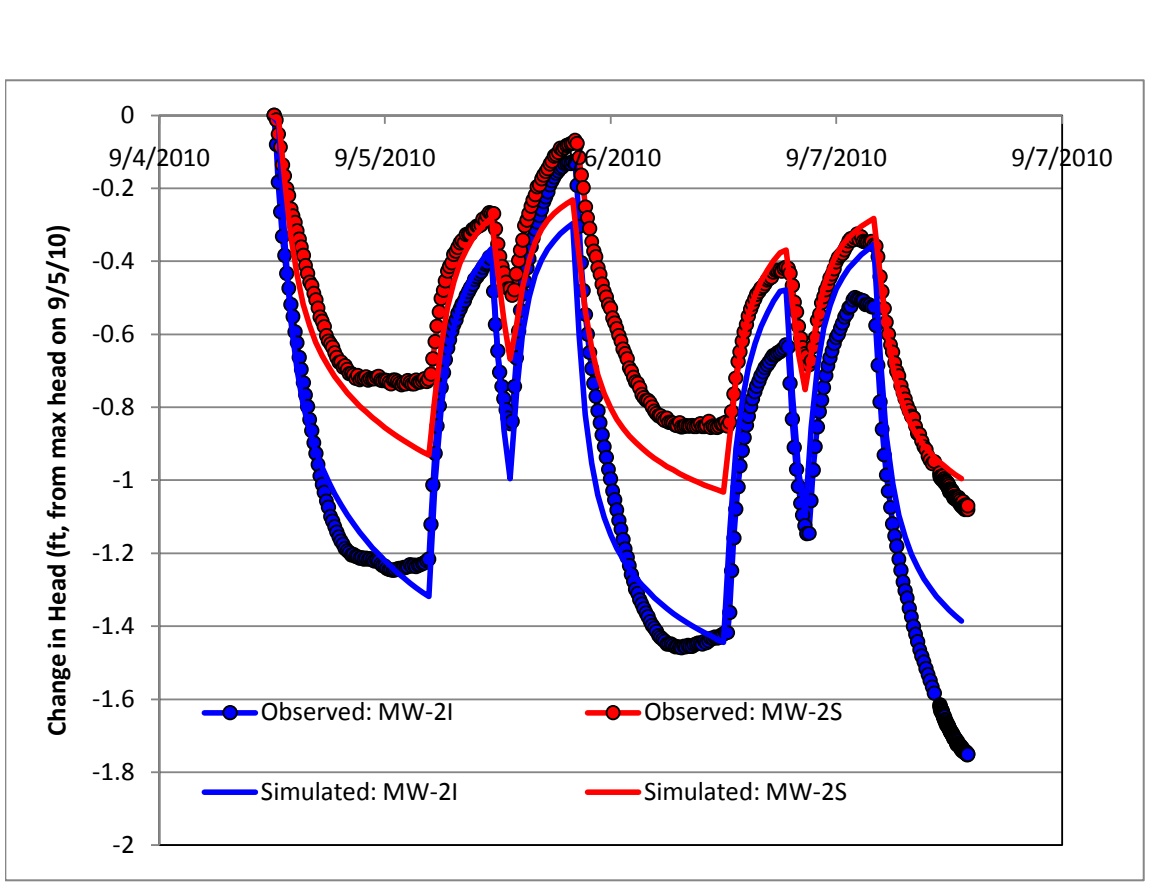
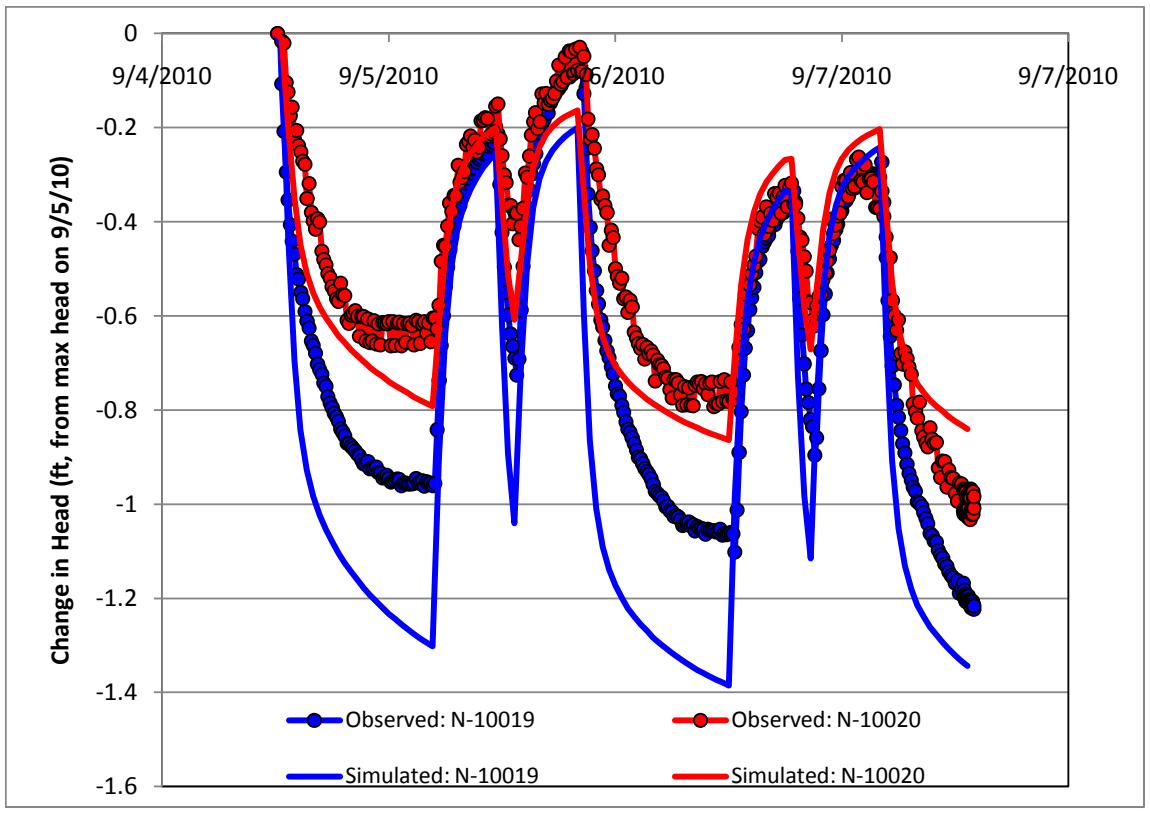
UM = Kh = 60 ft/d



Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 6 Simulated vs. observed head in MW-02. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



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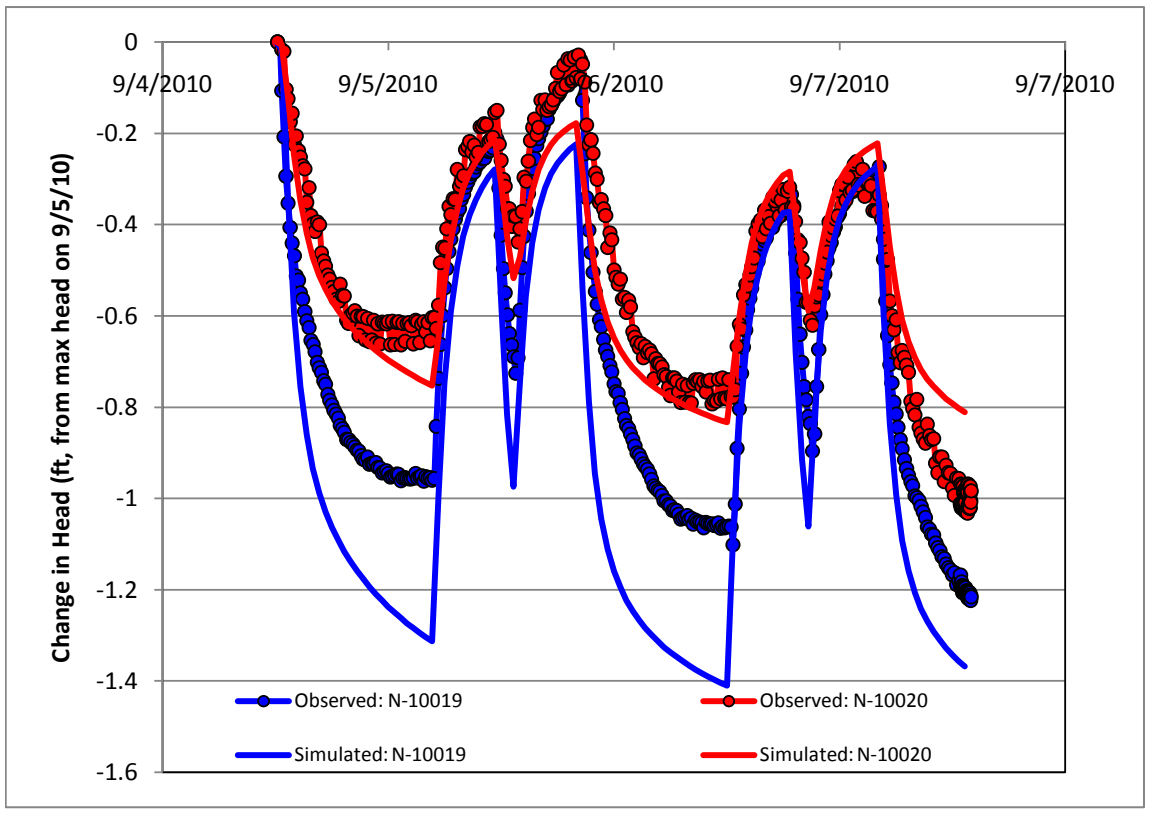

Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
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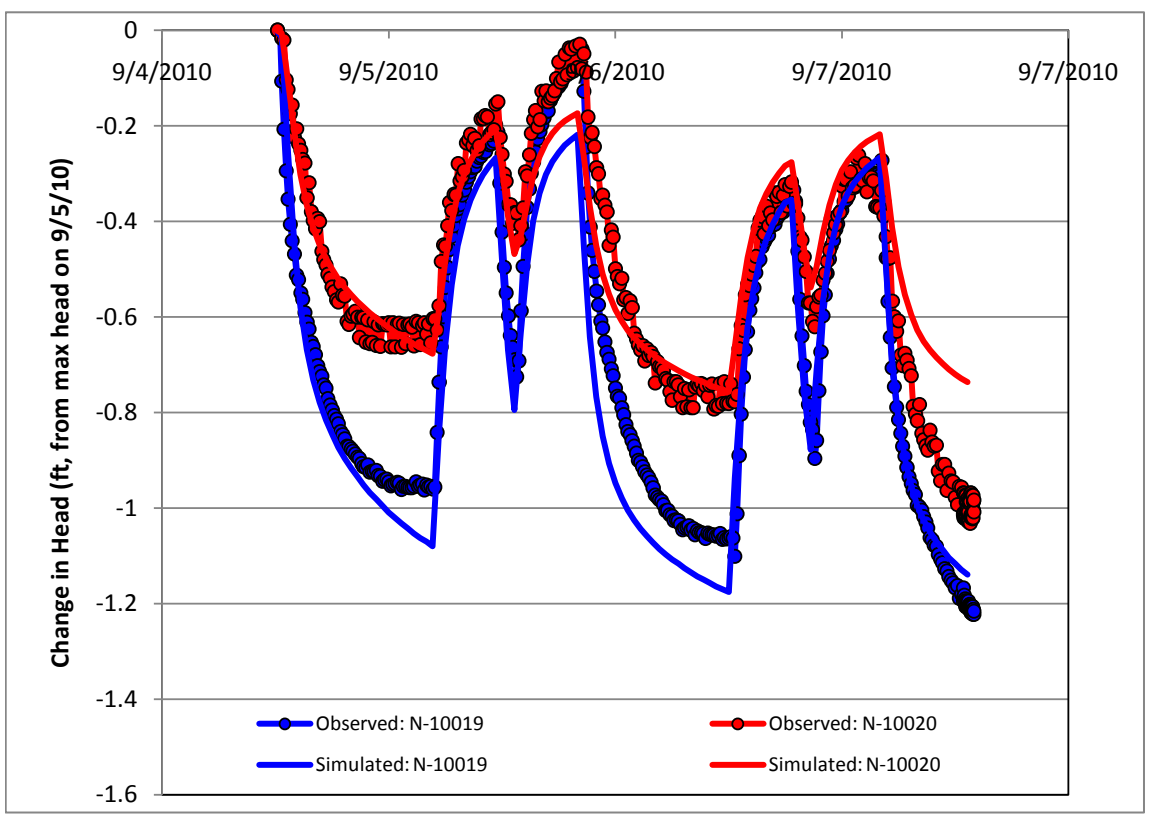
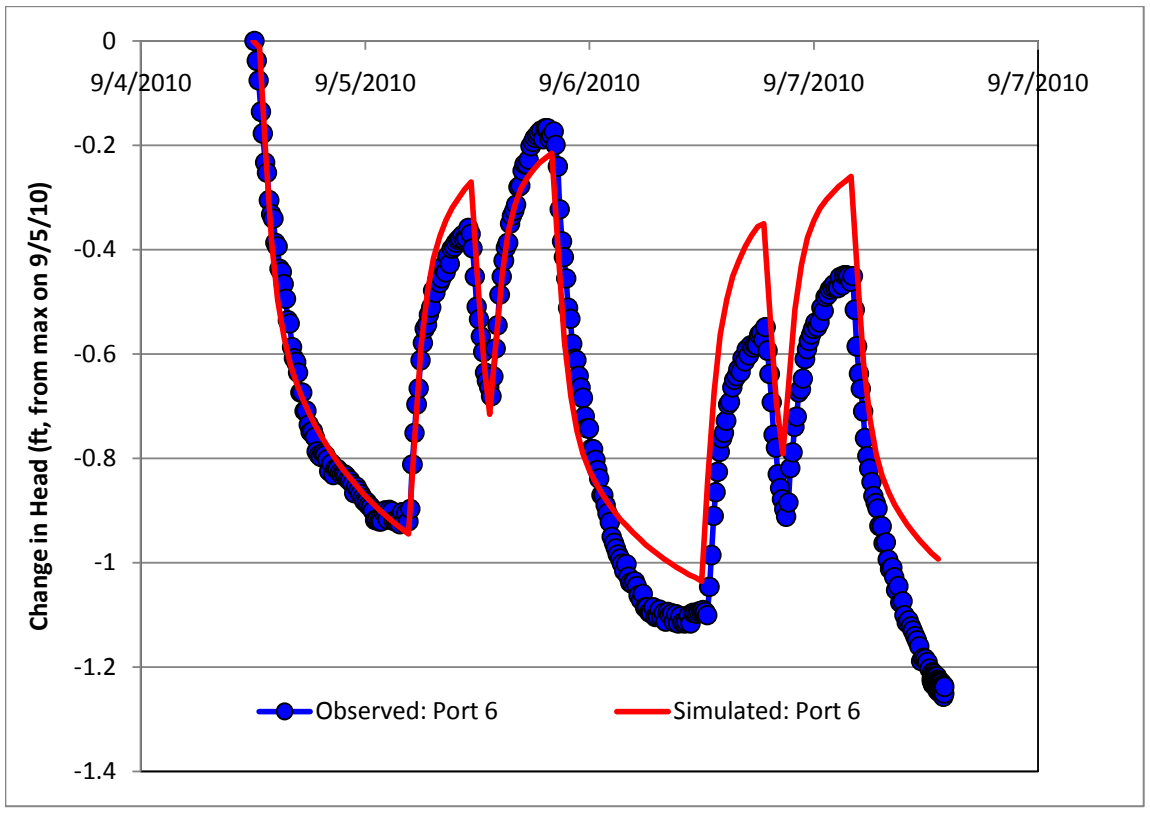
UM = Kh = 60 ft/d



Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 7 Simulated vs. observed head in NCDPW monitoring wells. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



Original Properties from calibrated model
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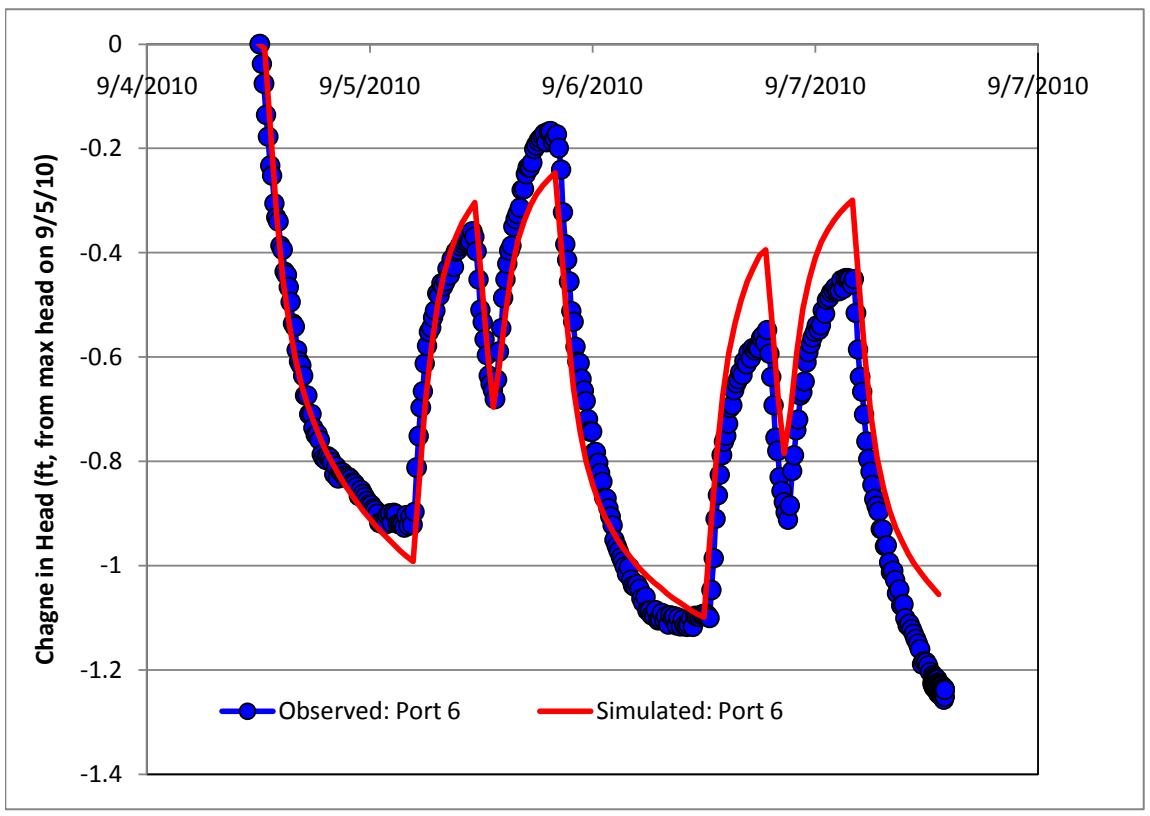
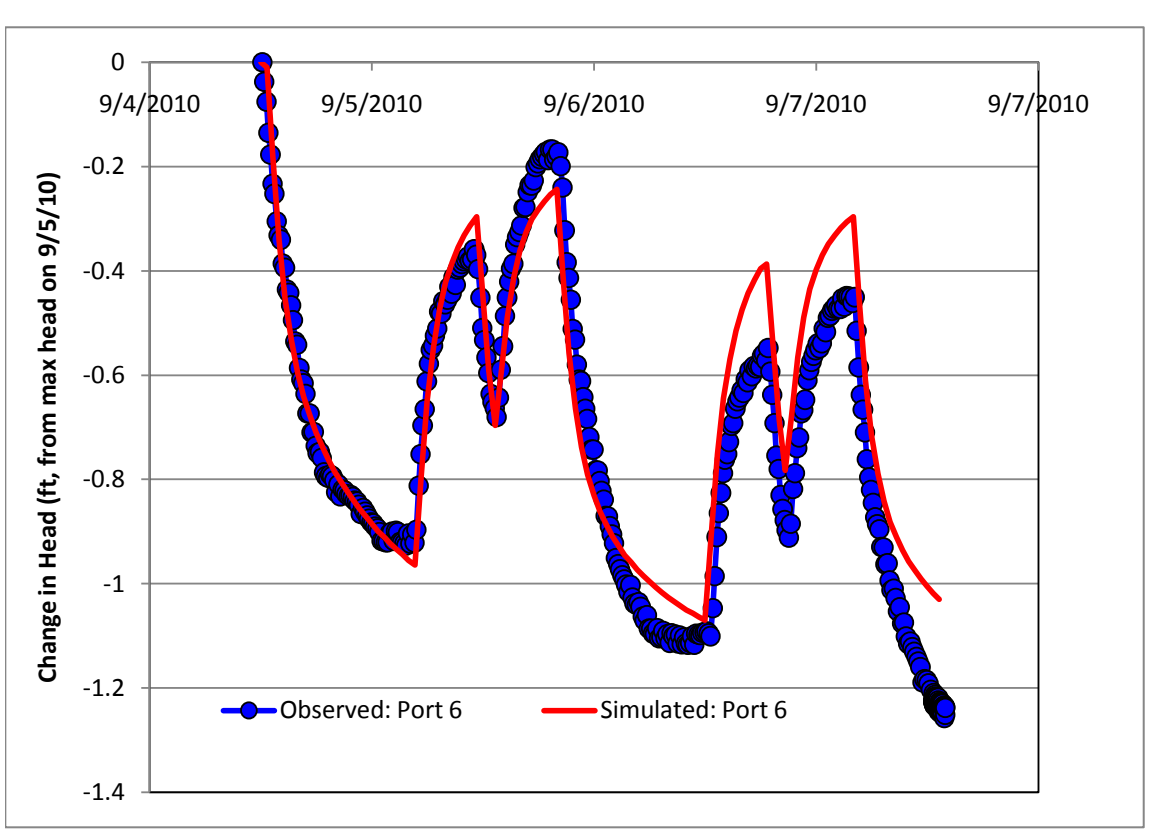
MM = 40/0.7 fpd
Sy = 0.25, Ss = 0.1E-5

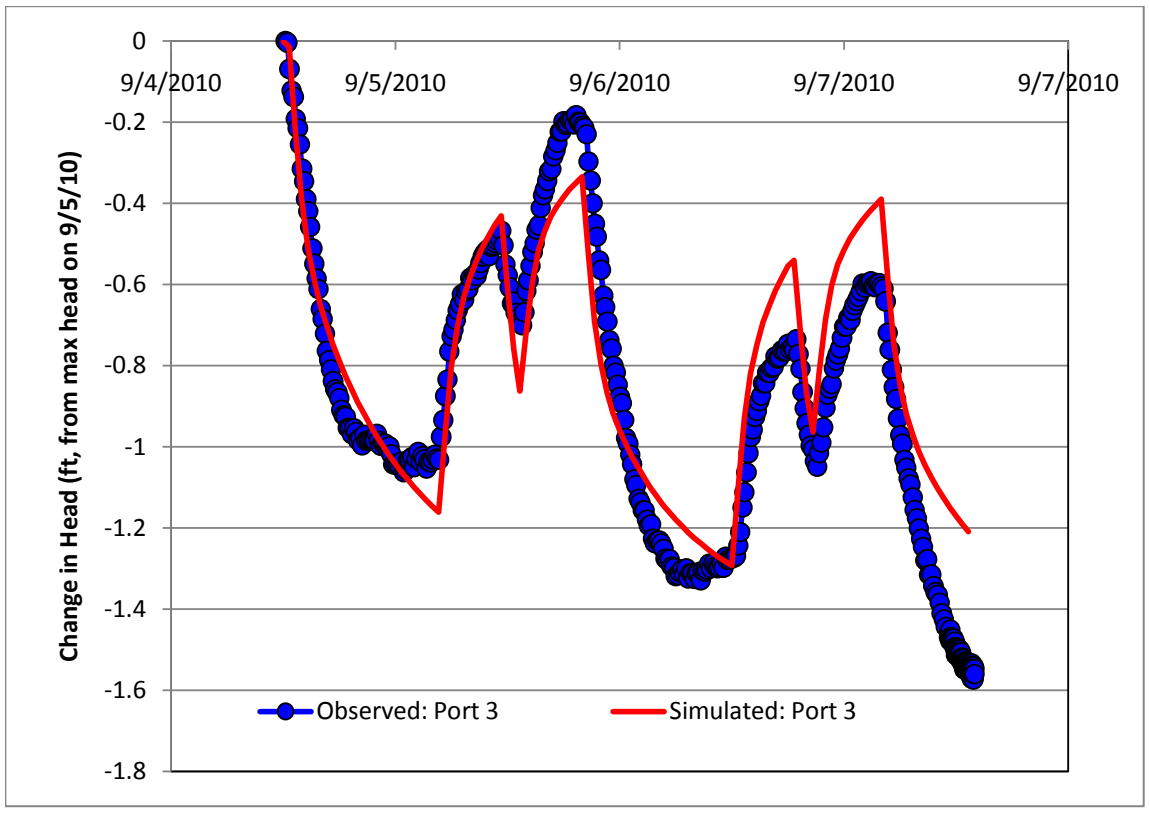


Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

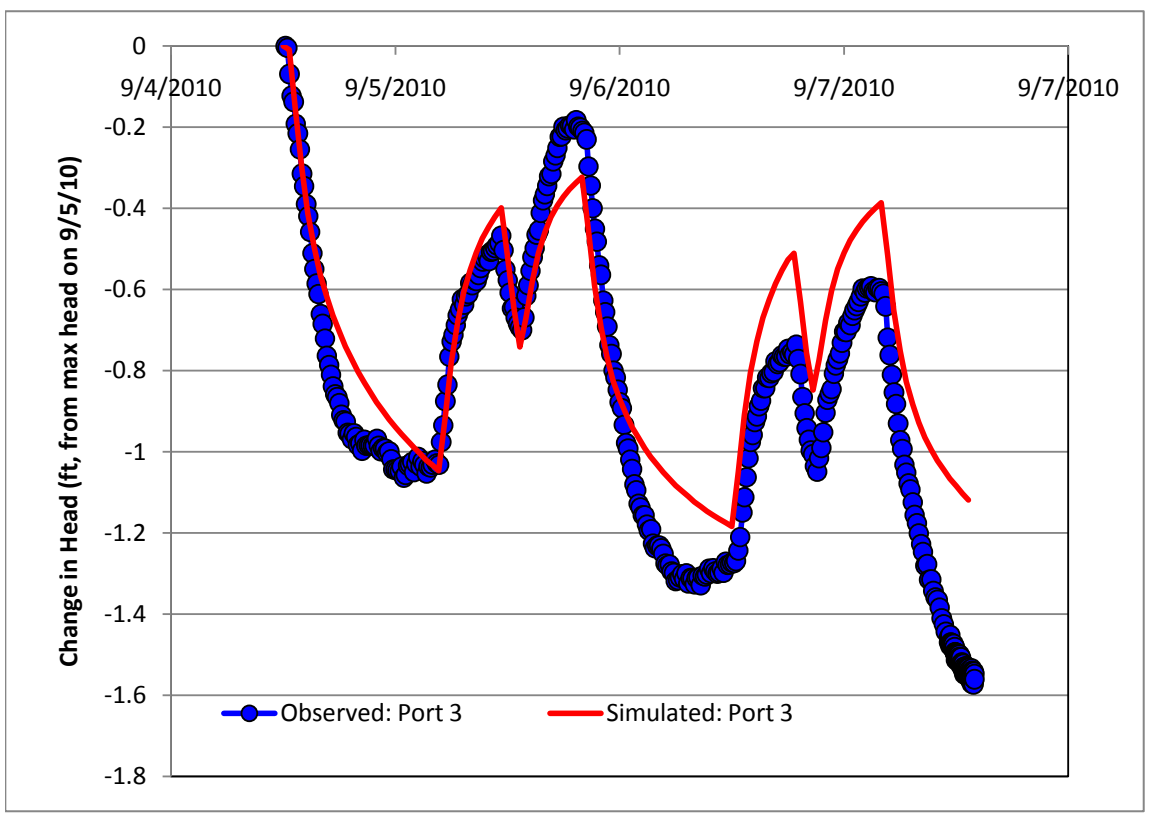


Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

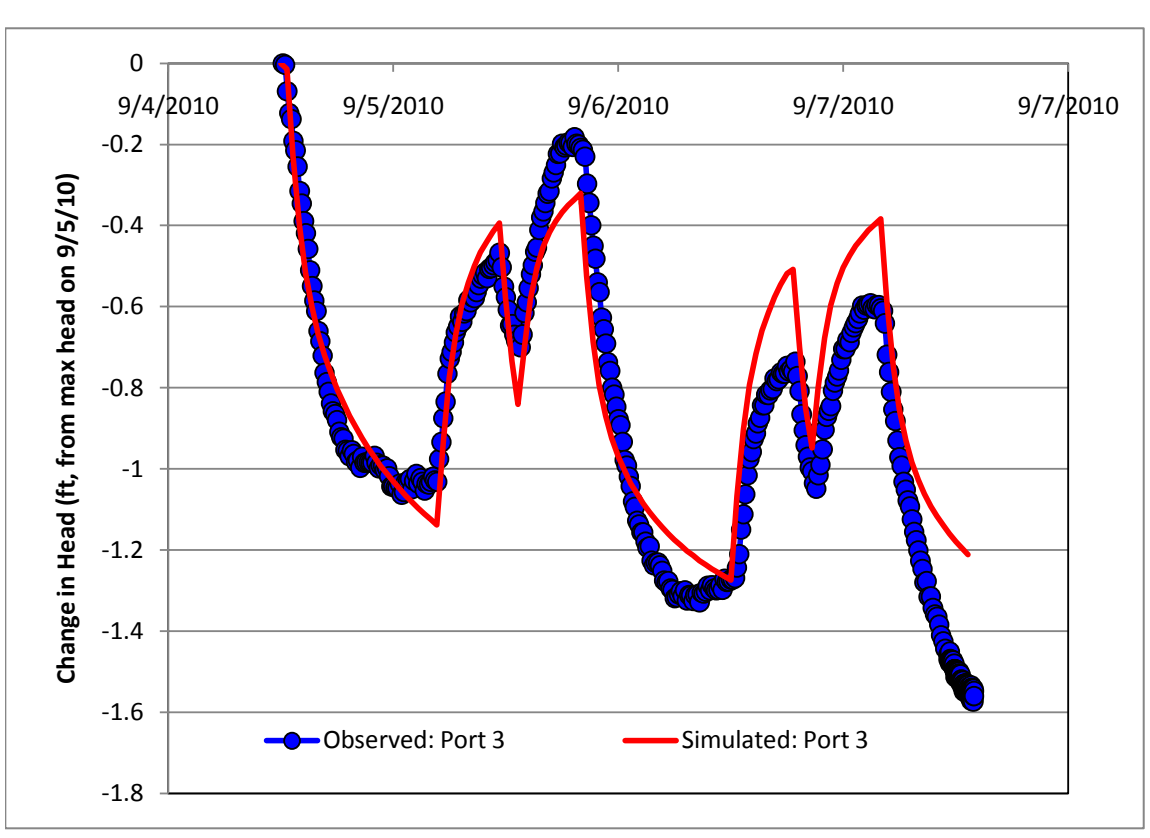
Figure 8 Simulated vs. observed head in SVP-04. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



Original Properties from calibrated model
UM = 35/0.60 fpd
MM = 40/0.7 fpd
Sy = 0.25, Ss = 0.1E-5

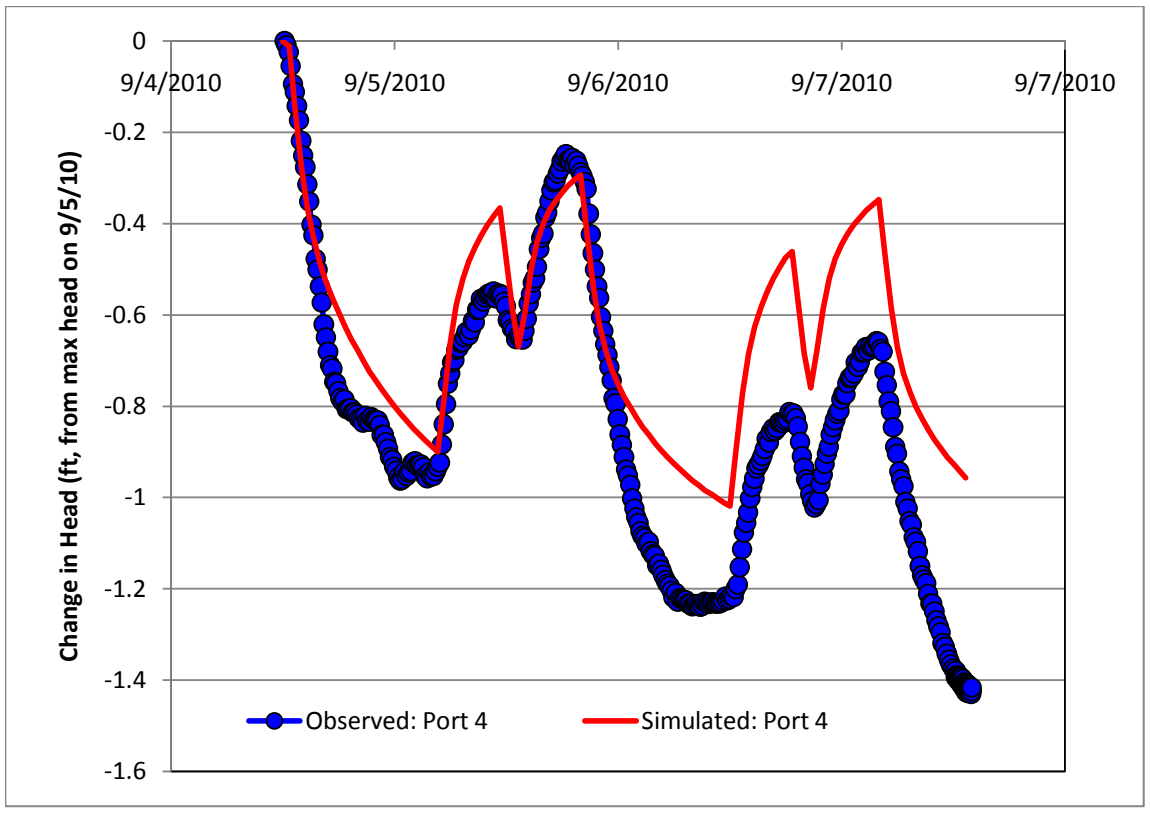


Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

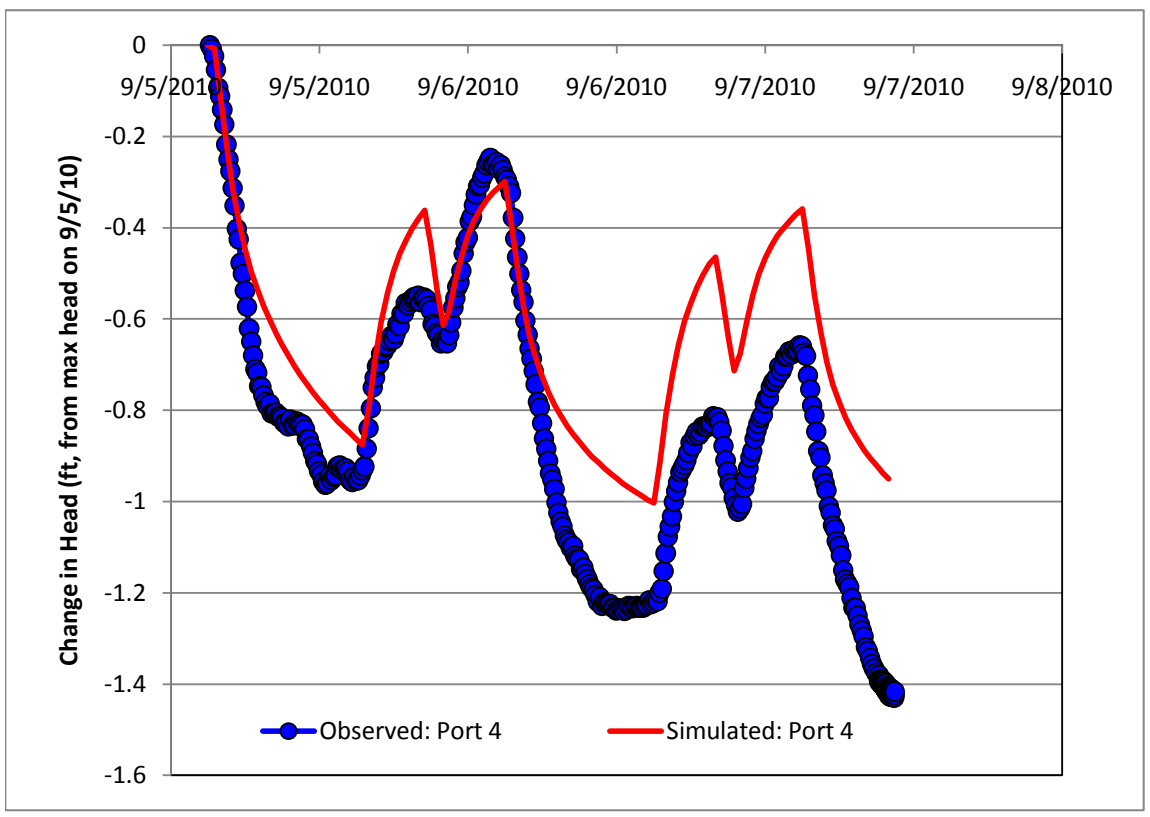


Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

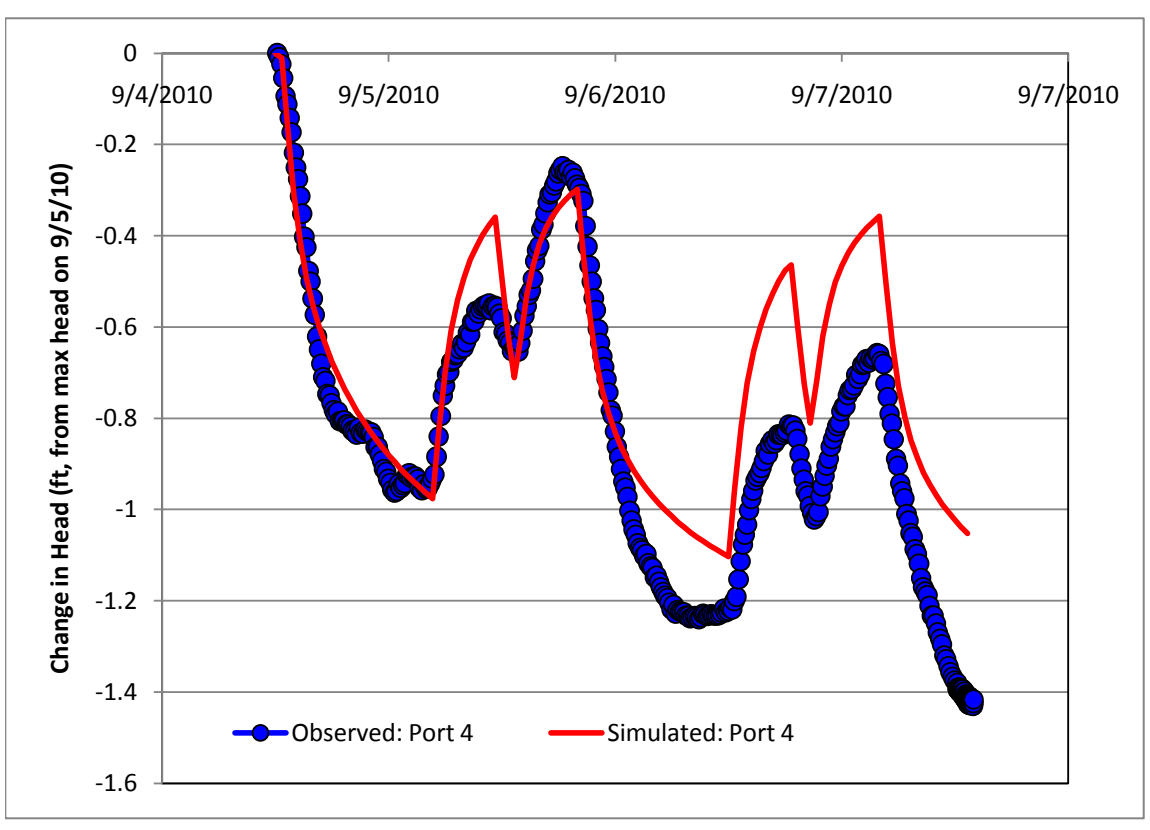
Figure 9 Simulated vs. observed head in SVP-03. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



Original Properties from calibrated model
UM = 35/0.60 fpd
MM = 40/0.7 fpd
Sy = 0.25, Ss = 0.1E-5

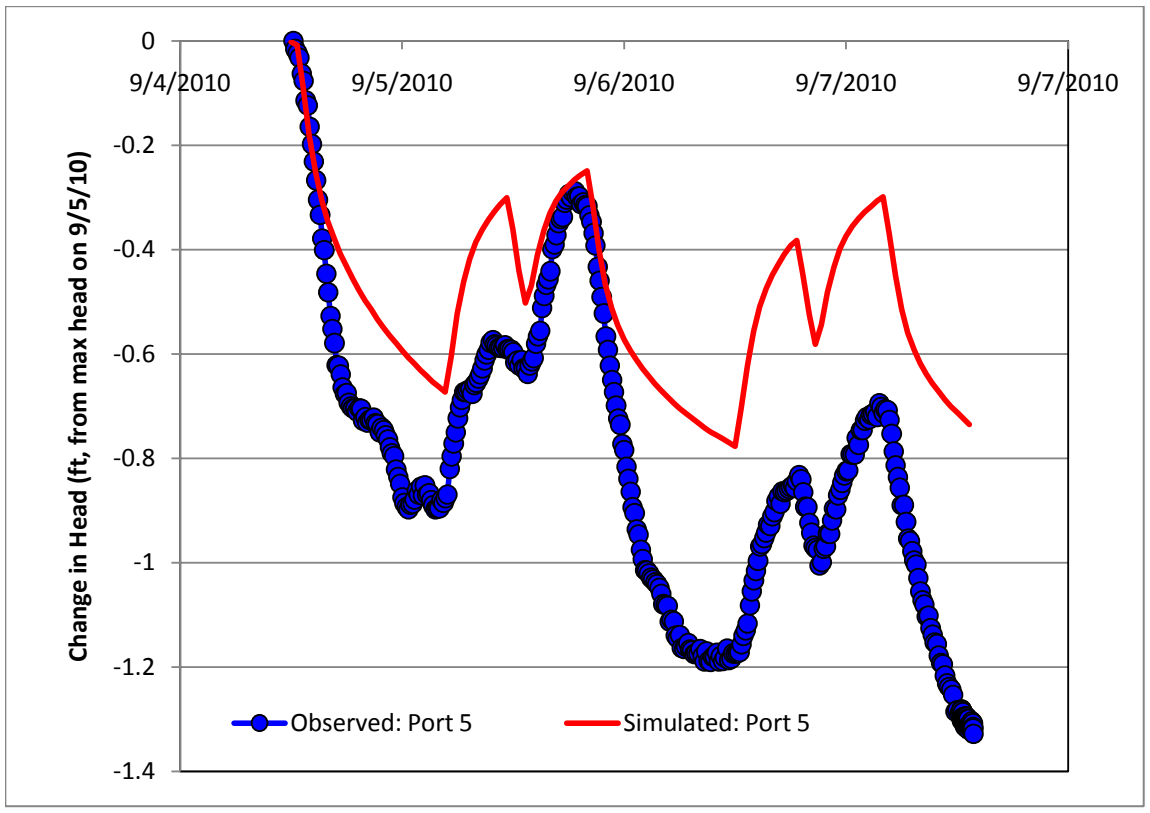


Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

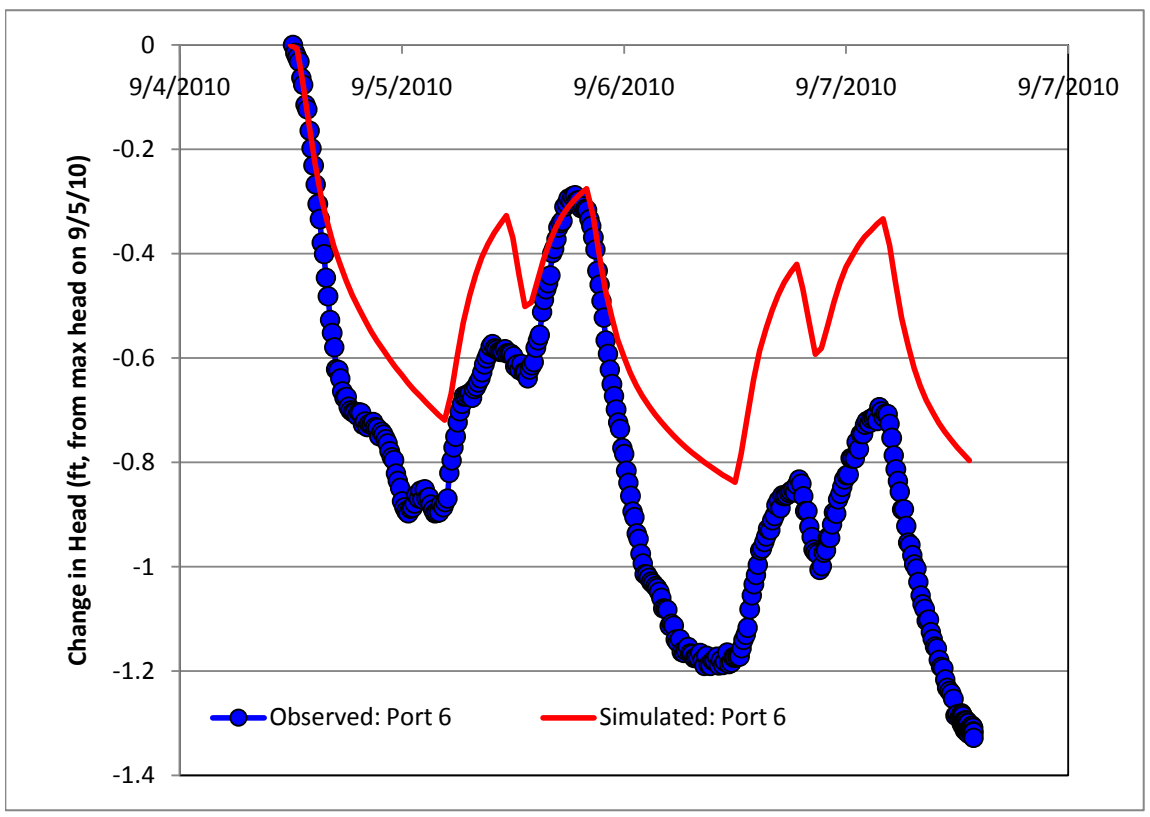


Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

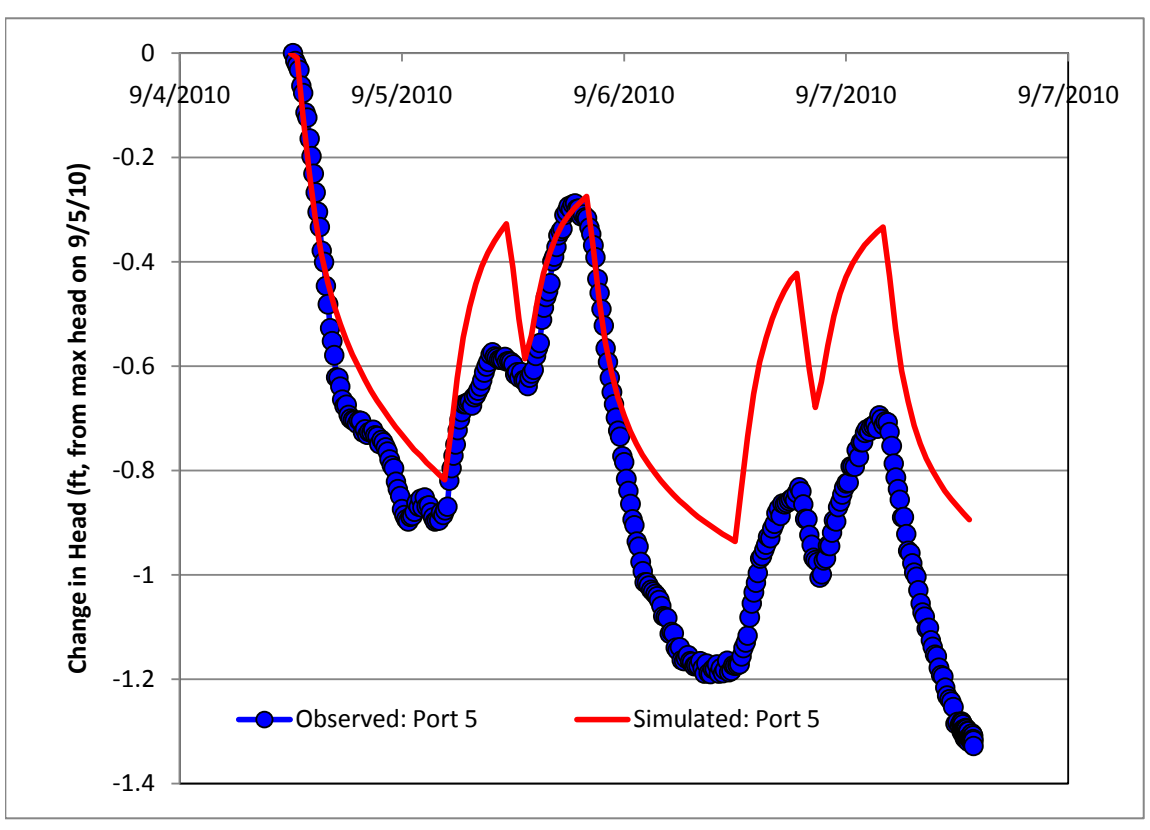
Figure 10 Simulated vs. observed head in SVP-02. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



Original Properties from calibrated model
UM = 35/0.60 fpd
MM = 40/0.7 fpd
Sy = 0.25, Ss = 0.1E-5

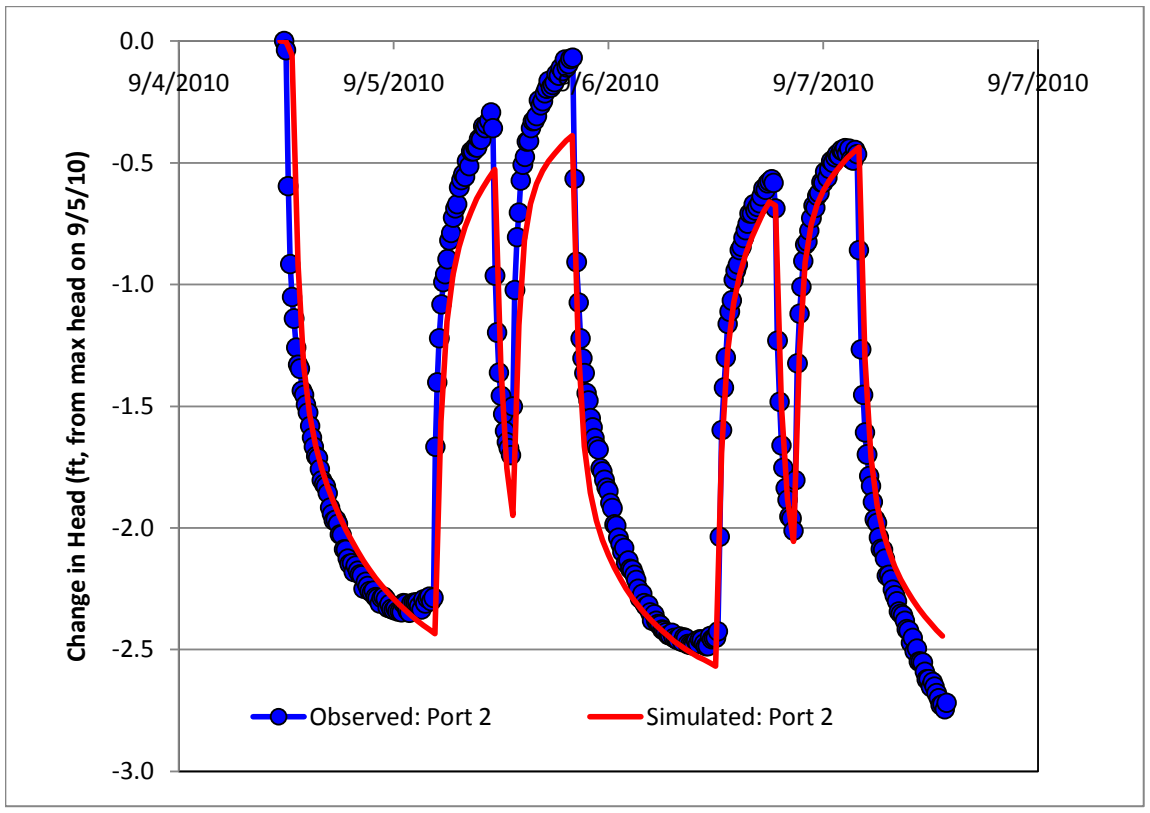


Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

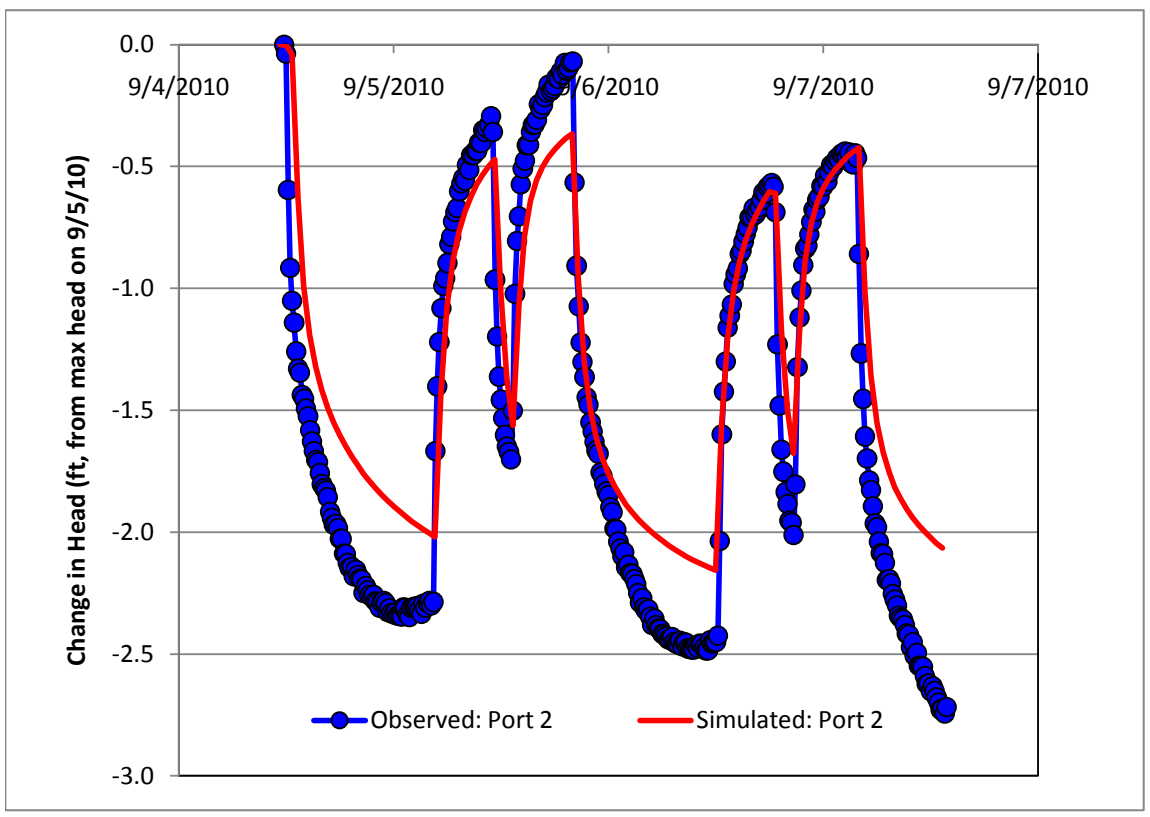


Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

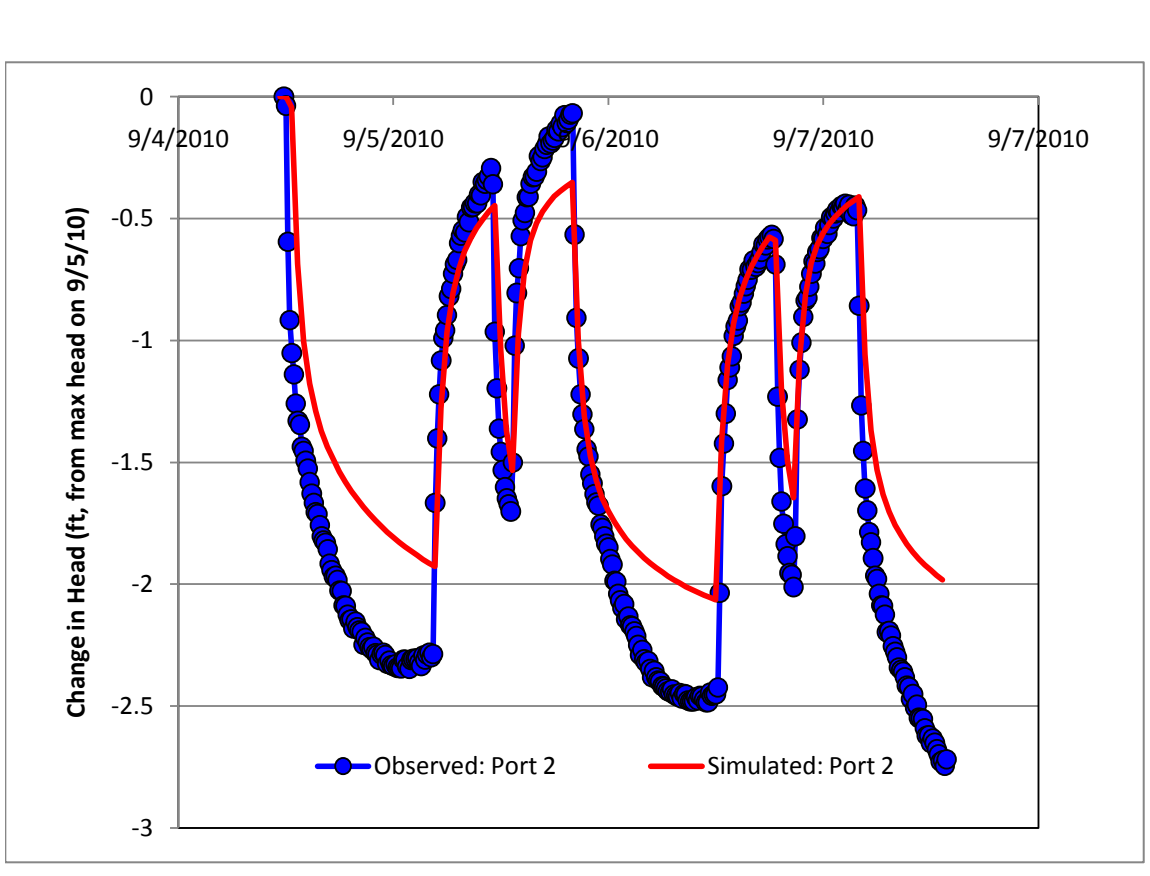
Figure 11 Simulated vs. observed head in SVP-09. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).



Original Properties from calibrated model
UM = 35/0.60 fpd
MM = 40/0.7 fpd
Sy = 0.25, Ss = 0.1E-5



Coarse Zone added within MM (K=80/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d



Coarse Zone added within MM (K=180/2 fpd)
modified storage properties slightly
Sy = 0.15 for Magothy, Ss = 0.2 E -5
UM = Kh = 60 ft/d

Figure 12 Simulated vs. observed head in SVP-11. Graphs on the left hand side are pre-aquifer test and represent background (pumping influence of Garden City supply wells only). Graphs to the right are during the aquifer test (EW-01 pumping).

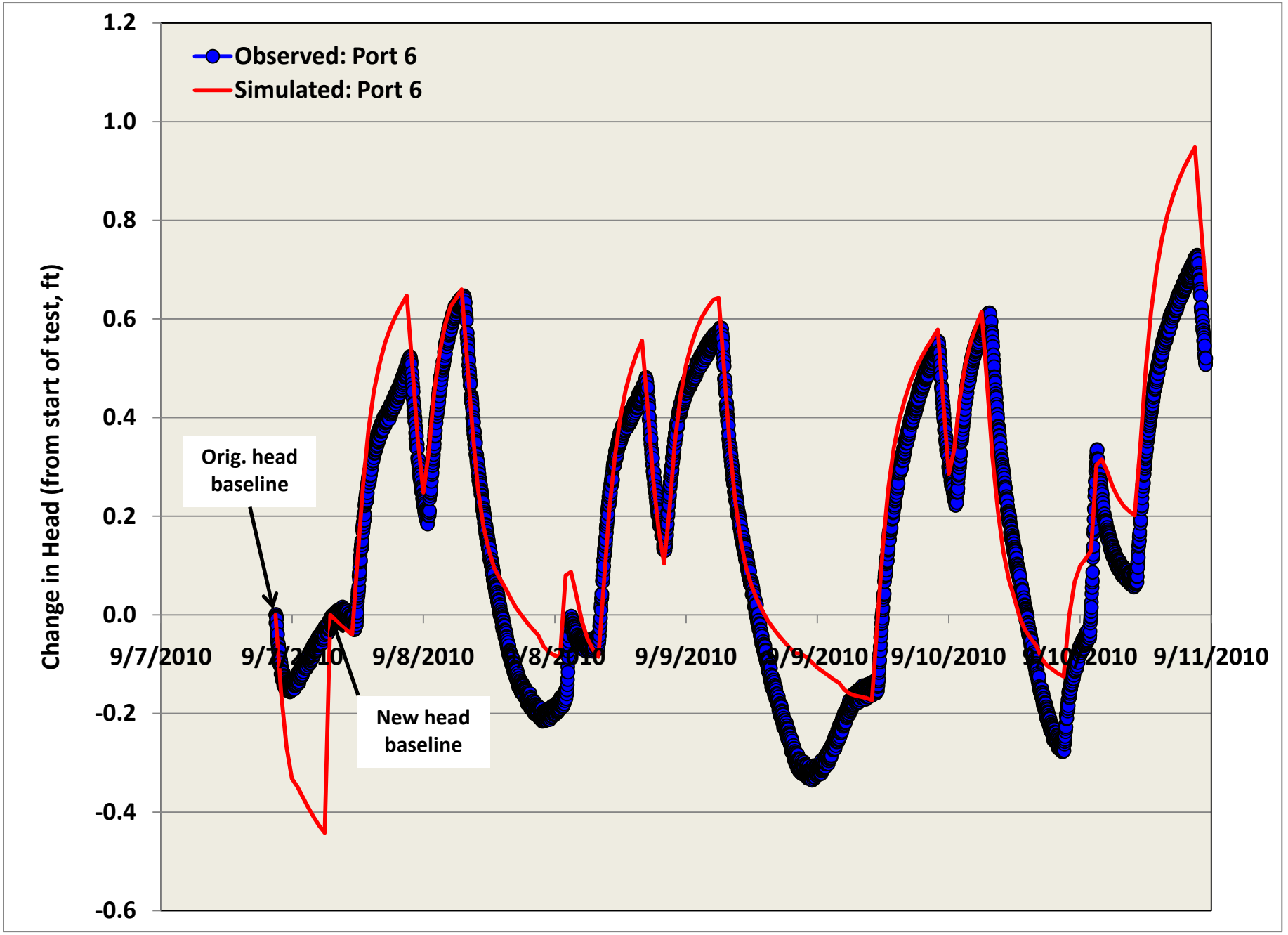
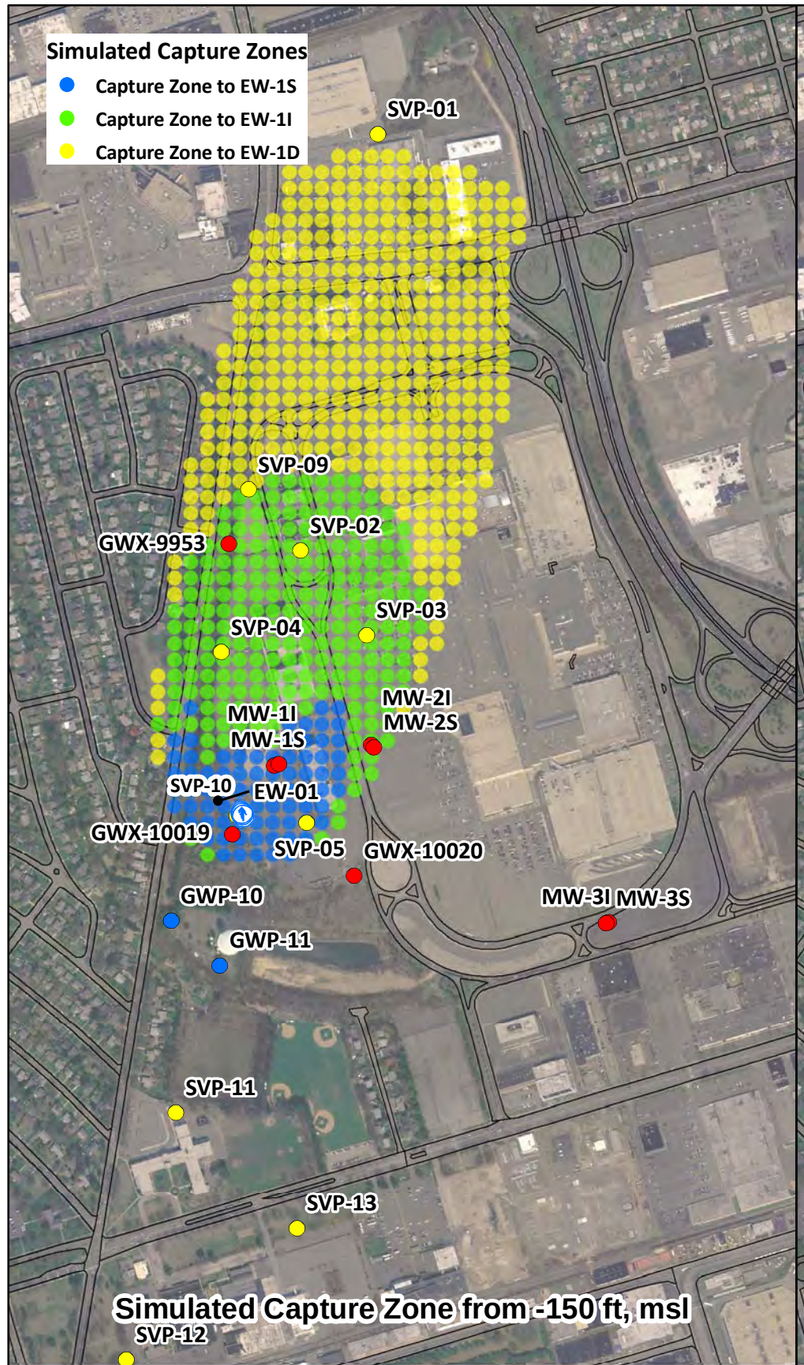
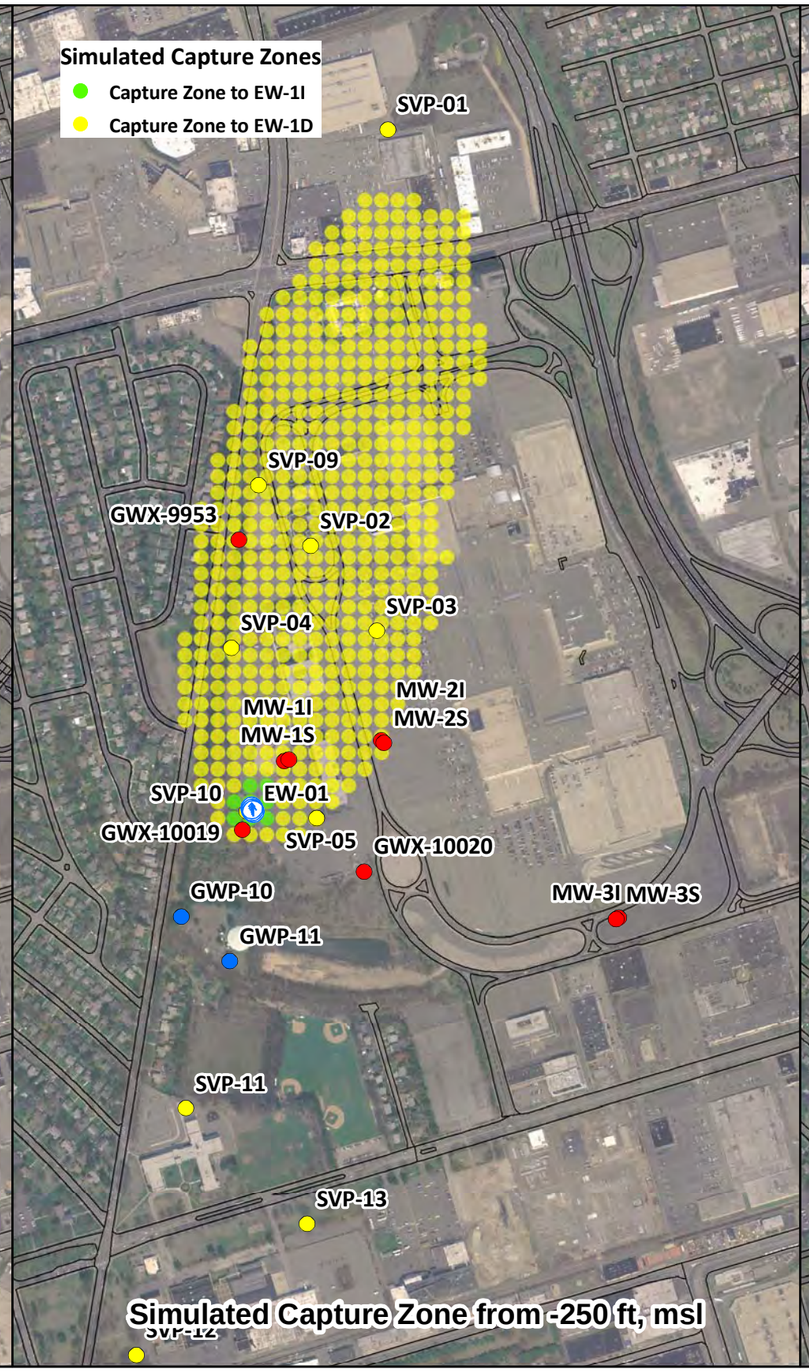
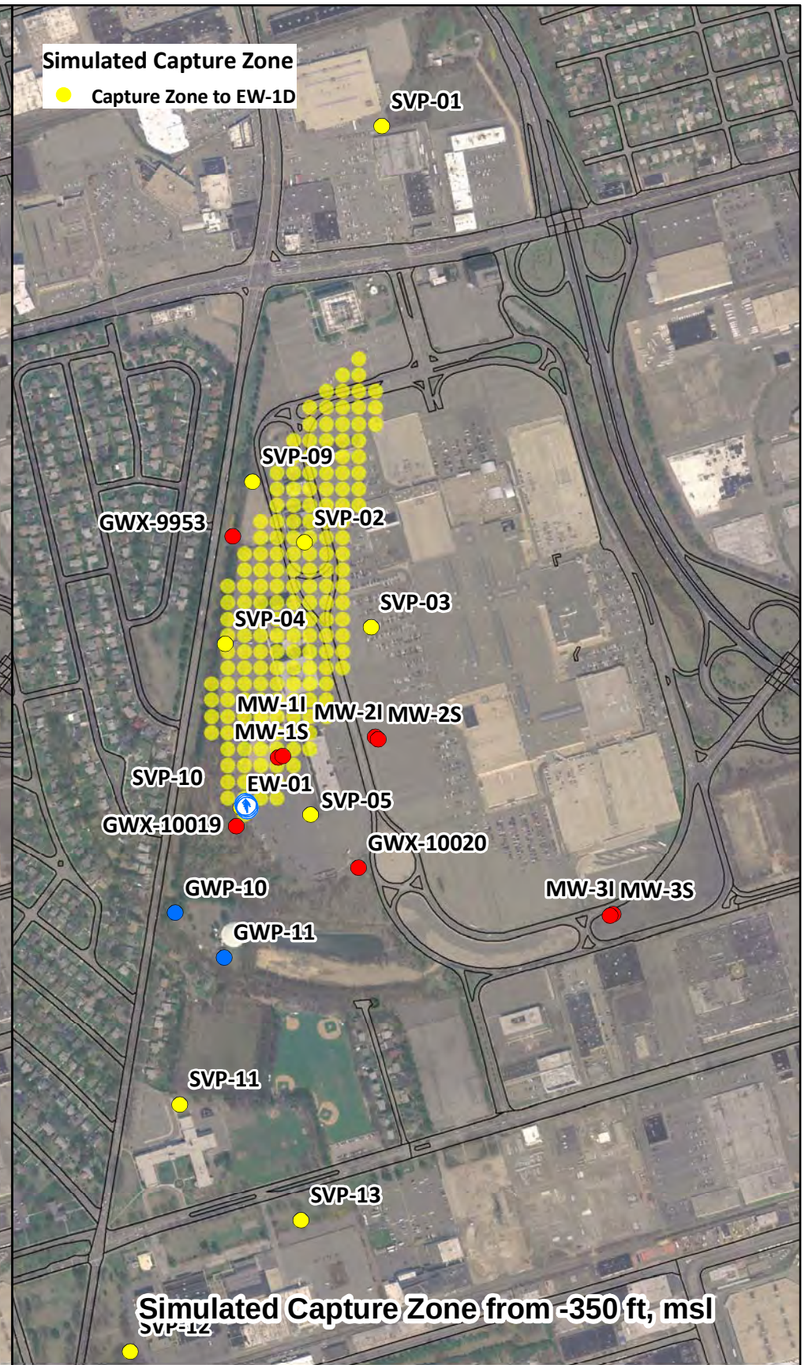


Figure 13
Simulated vs Observed Drawdown for SVP-04 (Port 6)
Simulated Dradown Measured from 9/7/10 15:29.







Extraction Well — EW-01 Pumping 250 gpm

Monitoring Well

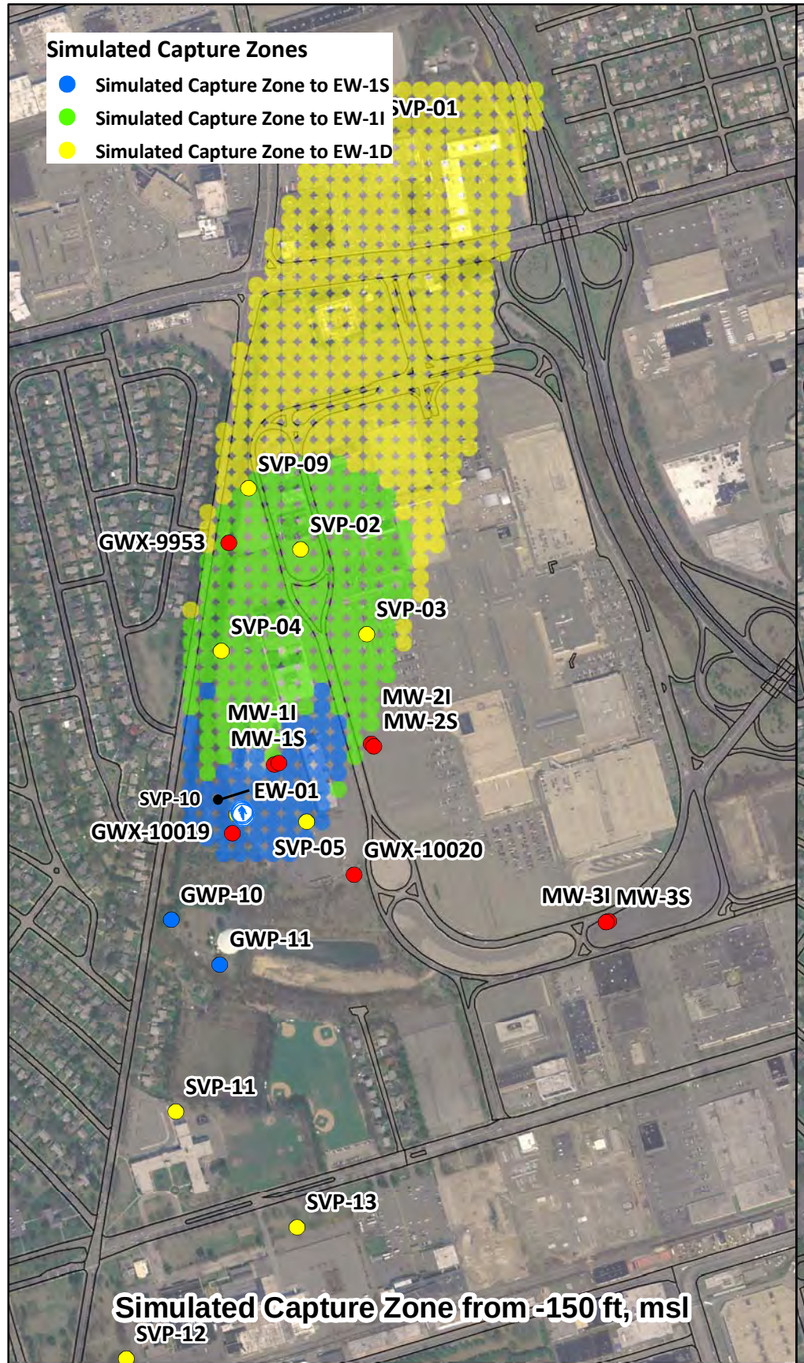
Multiport Well — Extraction Wells Screened:
-122 to -172 ft, msl (70 gpm)
-192 to -252 ft, msl (70 gpm)
-261 to -322 ft, msl (110 gpm)

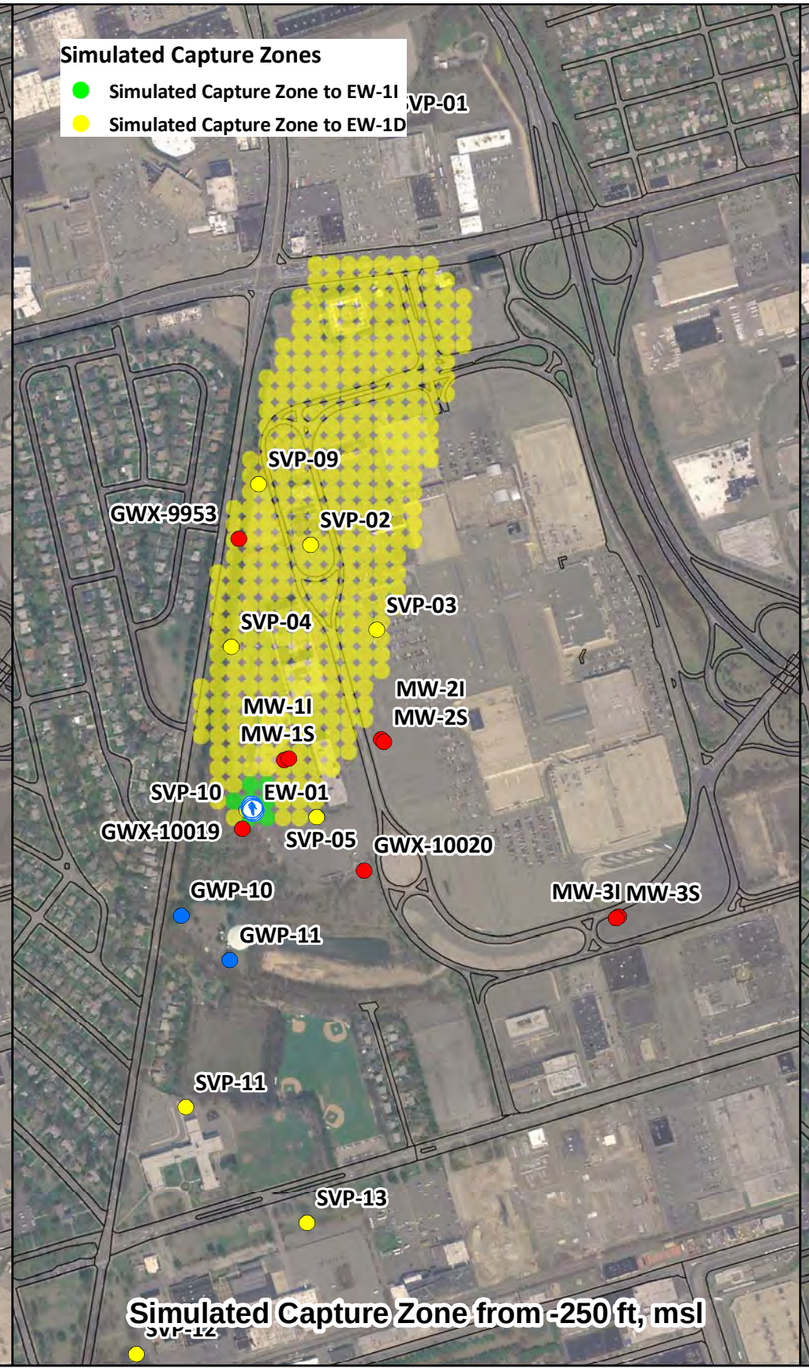
Pumping Well

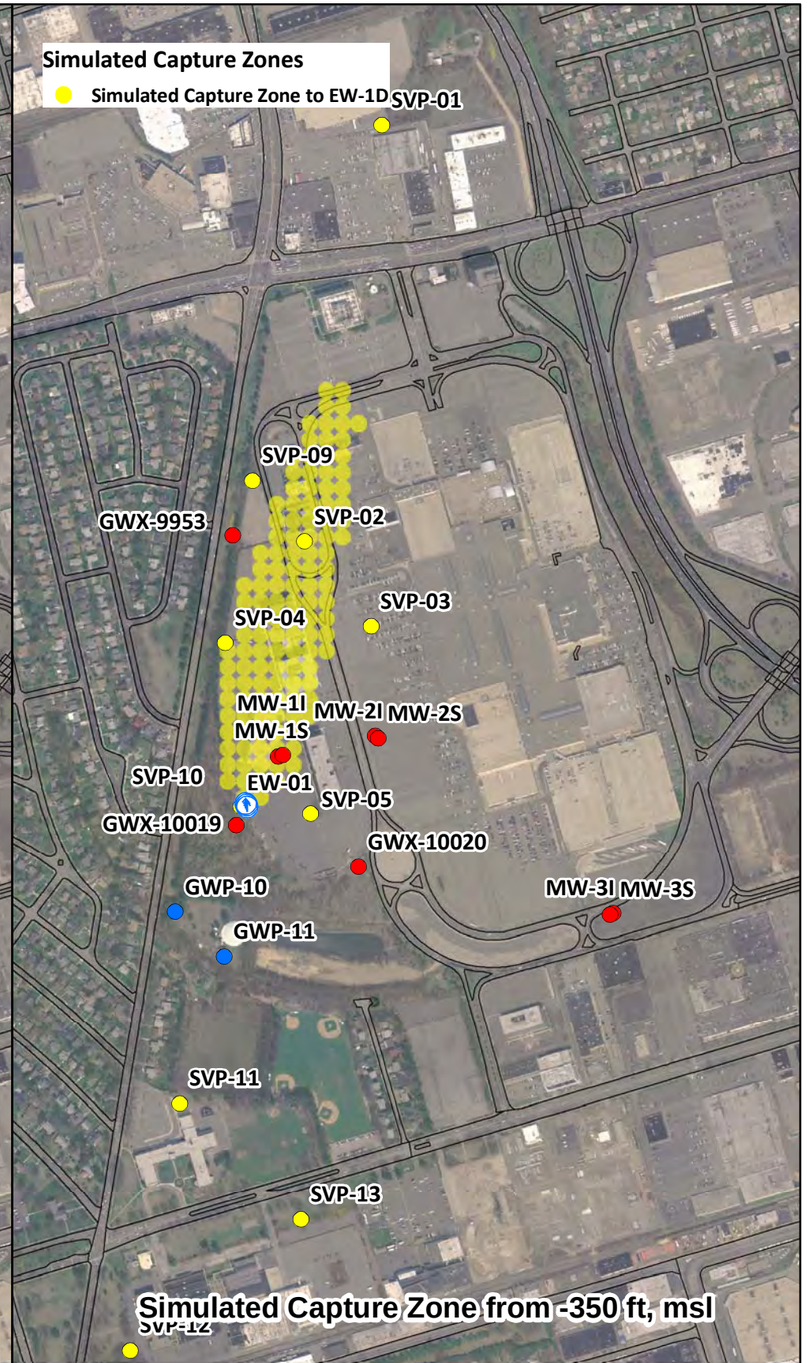
N

0 375 750 1,500 2,250 3,000 Feet

Figure 14
Simulated 15-Year Capture Zones to Recovery Well Cluster (EW-01)
Original Model Properties in Magothy
Old Roosevelt Field Contaminated Groundwater Site
Nassau County, New York
CDM







Extraction Well
Monitoring Well
Multiport Well
Pumping Well

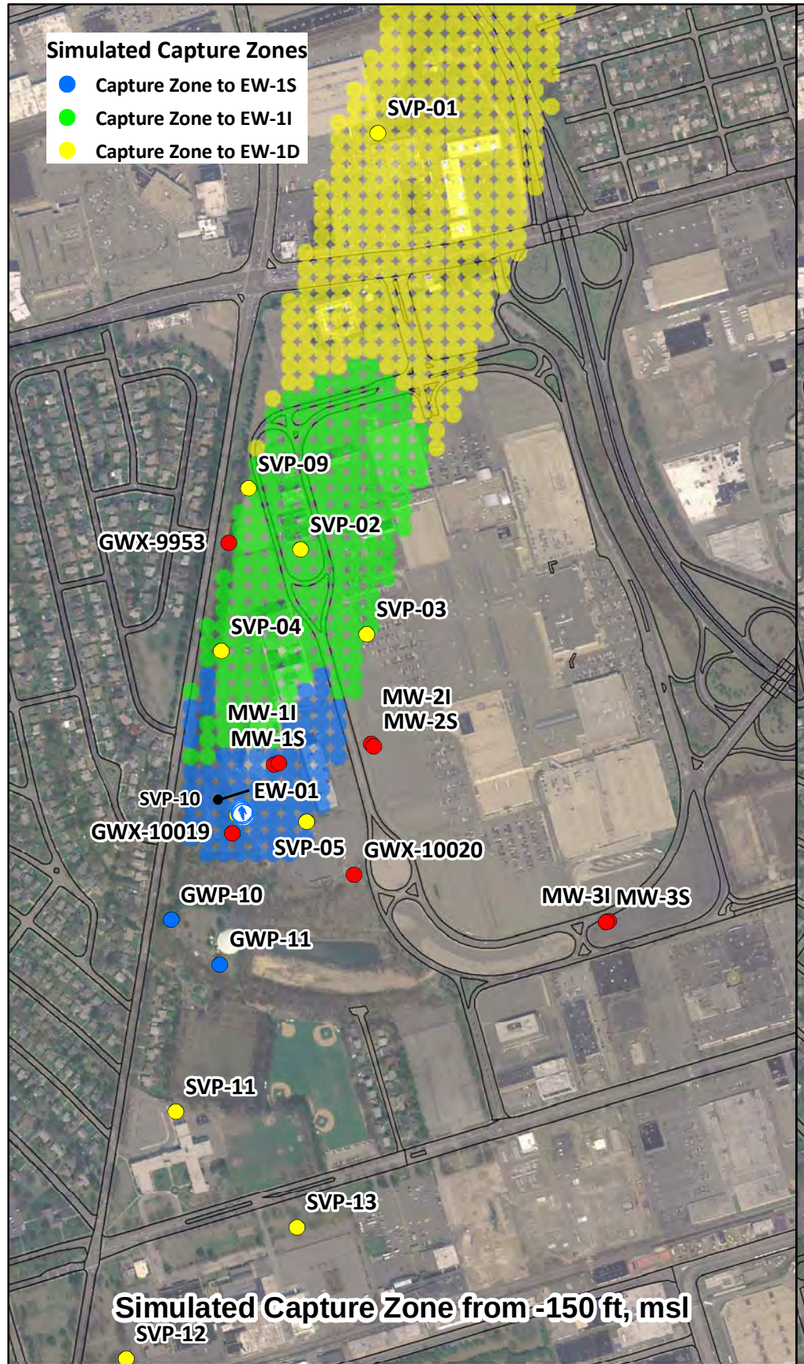
EW-01 Pumping 250 gpm

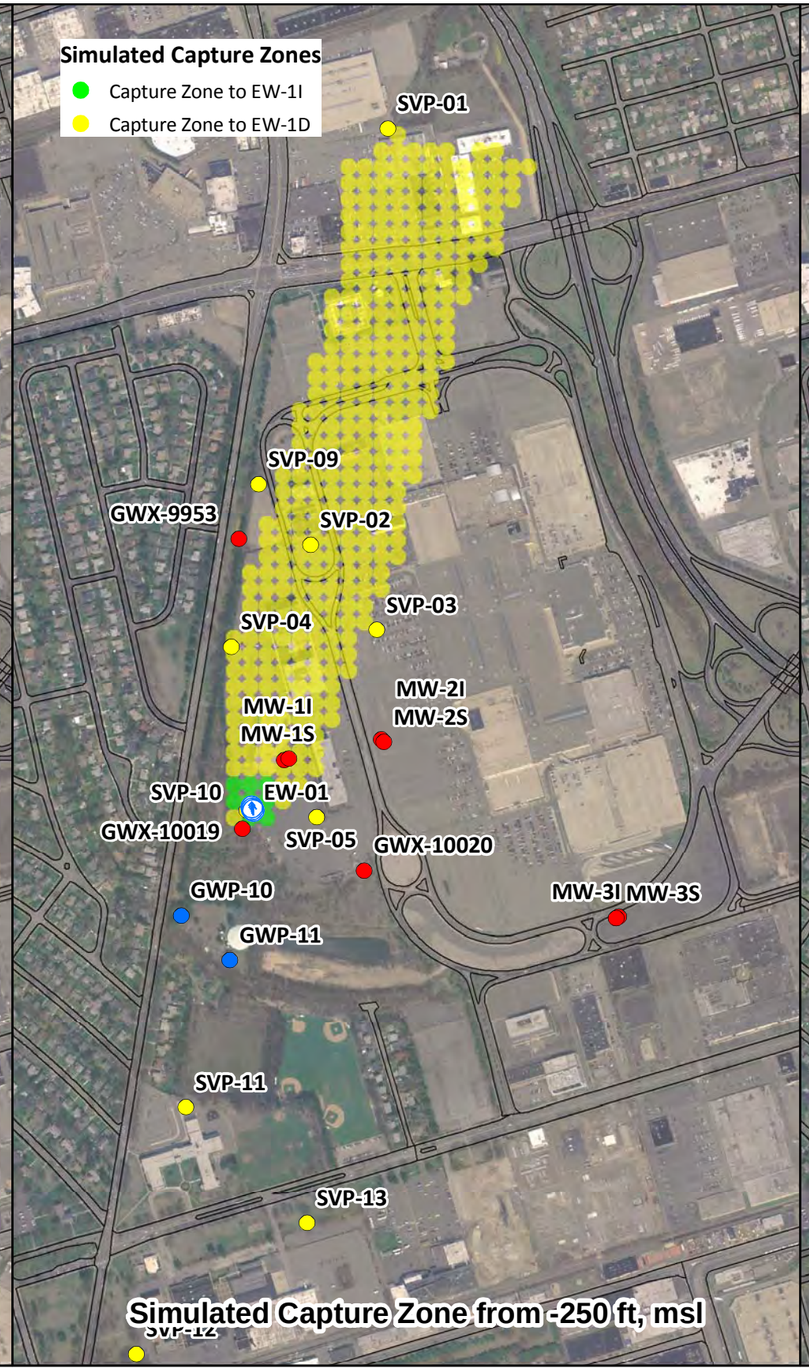
Extraction Wells Screened:
-122 to -172 ft, msl (70 gpm)
-192 to -252 ft, msl (70 gpm)
-261 to -322 ft, msl (110 gpm)

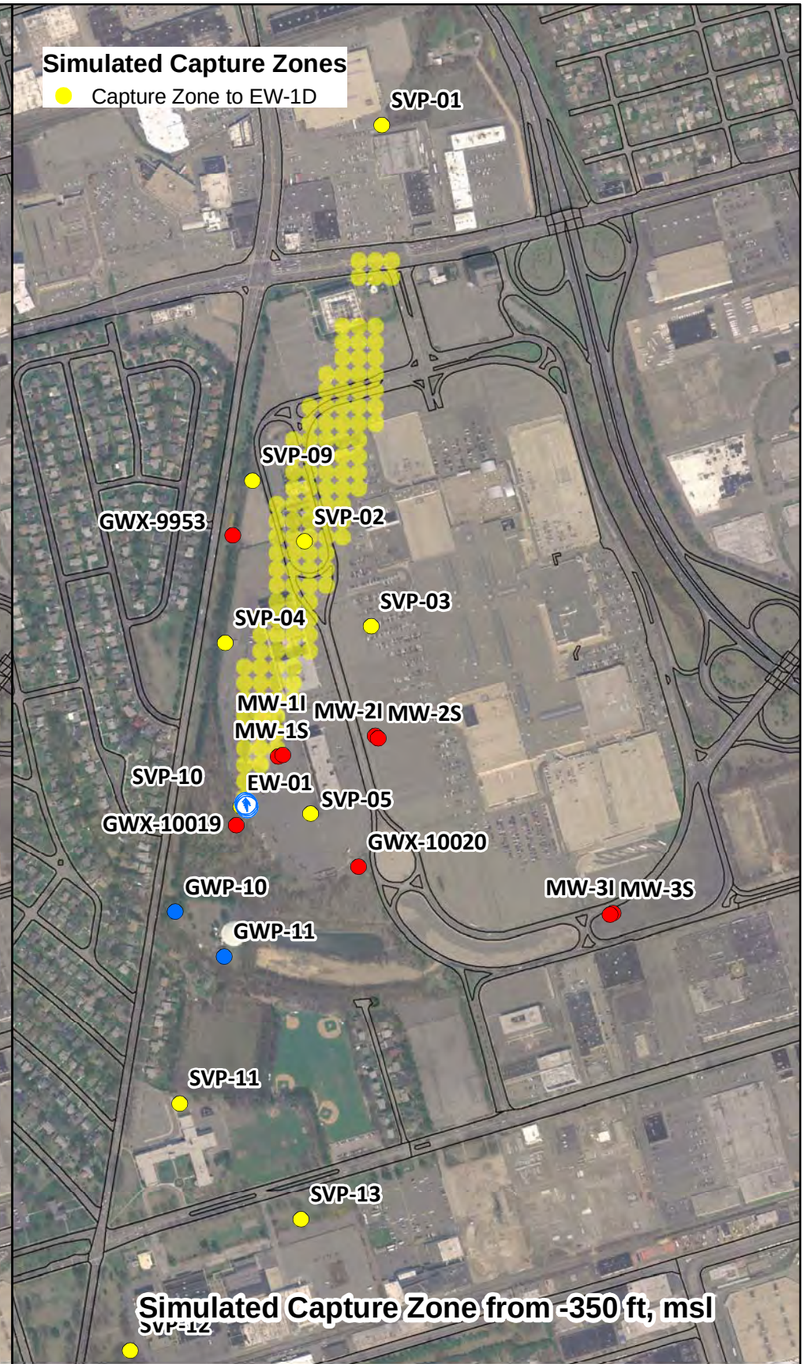
N

0 375 750 1,500 2,250 3,000 Feet

Figure 15
Simulated 15-Year Capture Zones to Recovery Well Cluster (EW-01)
Sandy Zone Incorporated (Kh = 80 ft/d)
Old Roosevelt Field Contaminated Groundwater Site
Nassau County, New York
CDM







Extraction Well
Monitoring Well
Multiport Well
Pumping Well

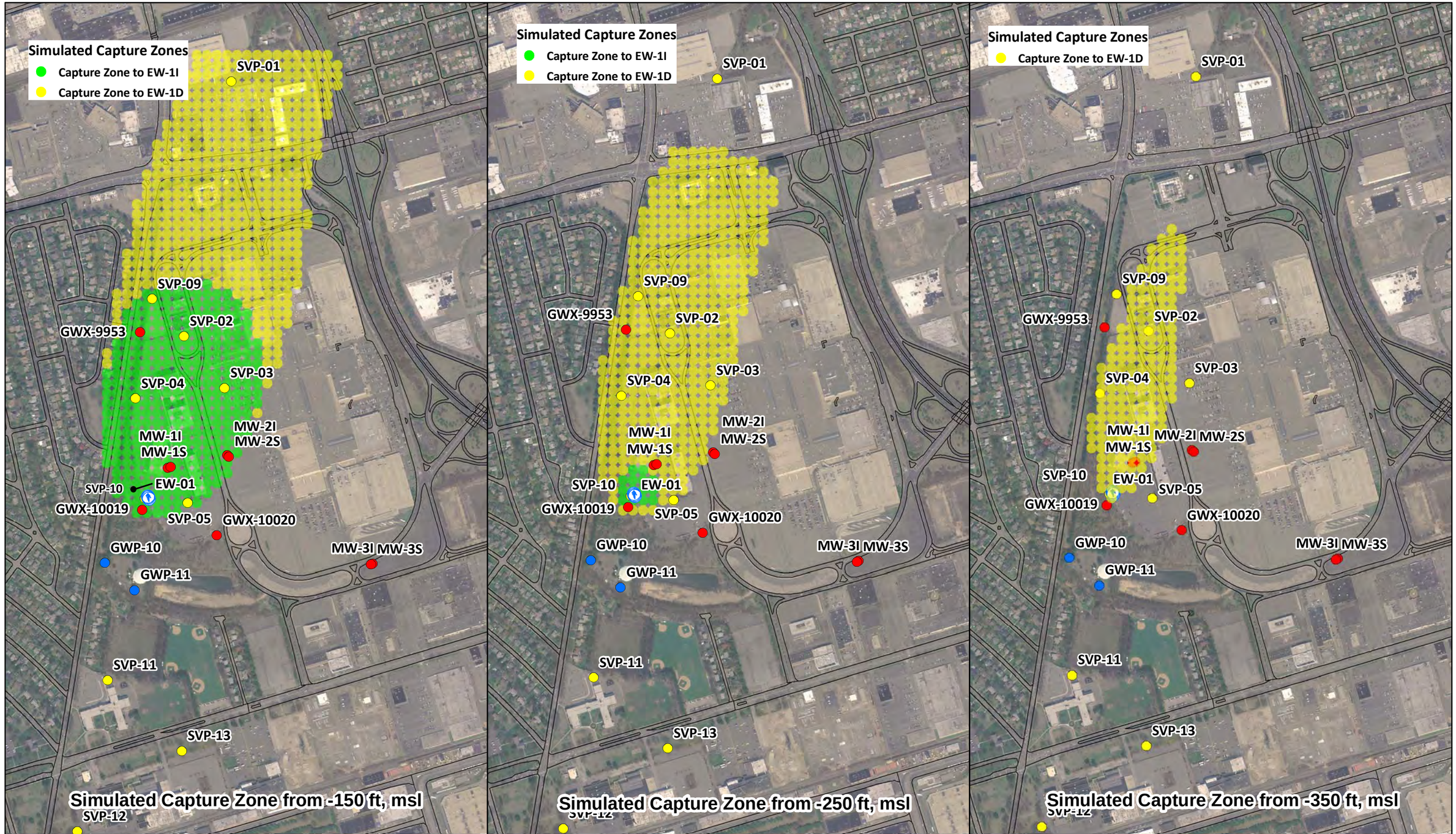
EW-01 Pumping 250 gpm

Extraction Wells Screened:
-122 to -172 ft, msl (70 gpm)
-192 to -252 ft, msl (70 gpm)
-261 to -322 ft, msl (110 gpm)

N

0 375 750 1,500 2,250 3,000 Feet

Figure 16
Simulated 15-Year Capture Zones to Recovery Well Cluster (EW-01)
Sandy Zone Incorporated (Kh = 180 ft/d)
Old Roosevelt Field Contaminated Groundwater Site
Nassau County, New York
CDM



Extraction Well
Monitoring Well
Multiport Well
Pumping Well

EW-01 Pumping 250 gpm

Extraction Wells Screened:
-122 to -172 ft, msl (OFF)
-192 to -252 ft, msl (125 gpm)
-261 to -322 ft, msl (125 gpm)

N

0 375 750 1,500 2,250 3,000 Feet

Figure 17
Simulated 15-Year Capture Zones to Recovery Well Cluster (EW-01)
Sandy Zone Incorporated (Kh = 80 ft/d)
Old Roosevelt Field Contaminated Groundwater Site
Nassau County, New York

CDM